

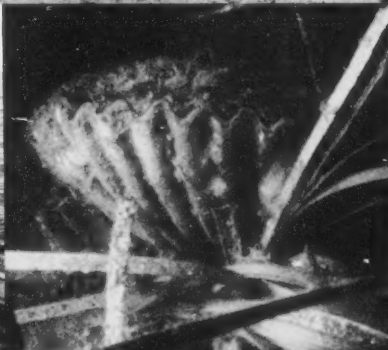
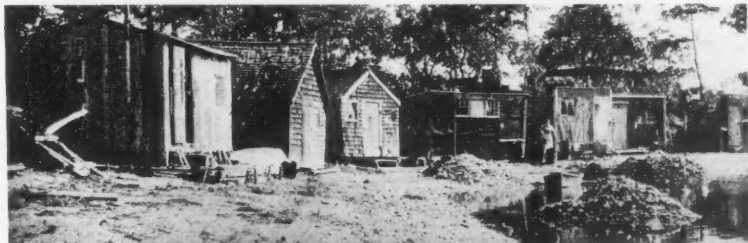


Marine Fisheries

REVIEW

Vol. 70, No. 3-4
2008

United States Department of Commerce



Bay Scallops in Eastern North America: Part I



Marine Fisheries REVIEW

W. L. Hobart, Editor
J. A. Strader, Managing Editor



On the cover:
A selection of
photos showing
many scenes from
the scallop fishery
over the last century.



70(3-4), 2008

History of the Bay Scallop, <i>Argopecten irradians</i> , Fisheries and Habitats in Eastern North America, Massachusetts through Northeastern Mexico	Clyde L. MacKenzie, Jr.	1
The Bay Scallop, <i>Argopecten irradians</i> , Massachusetts Through North Carolina: Its Biology and the History of Its Habitats and Fisheries	Clyde L. MacKenzie, Jr.	6
Annual Index		80
List of Papers		82

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The *Marine Fisheries Review* (ISSN 0090-1830) is published quarterly by the Scientific Publications Office, National Marine Fisheries Service, NOAA, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115. Annual subscriptions are sold by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. The annual subscription price is \$21.00 domestic, \$29.40 foreign. Single copies are \$12.00 domestic, \$16.80 foreign. For new subscriptions write: New Orders, Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954.

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This publication is available online at
<http://spo.nwr.noaa.gov/mcontent.htm>

History of the Bay Scallop, *Argopecten irradians*, Fisheries and Habitats in Eastern North America, Massachusetts through Northeastern Mexico

Preface

This is a broad historical overview of the bay scallop, *Argopecten irradians*, fishery on the East and Gulf Coasts of North America (Fig. 1). For a little over a century, from about the mid 1870's to the mid 1980's, bay scallops supported large commercial fisheries mainly in the U.S. states of Massachusetts, New York, and North Carolina and on smaller scales in the states in between and in western Florida. In these states, the annual harvests and dollar value of bay scallops were far smaller than those of the other important commercial mollusks, the eastern oysters, *Crassostrea virginica*, and northern quahogs, *Mercenaria mercenaria*, but they were higher than those of softshell clams, *Mya arenaria* (Table 1). The fishery had considerable economic importance in the states' coastal towns, because bay scallops are a high-value product and the fishery was active during the winter months when the economies in most towns were otherwise slow. The scallops also had cultural importance as a special food, an ornament owing to its pretty shell design, and an interesting biological component of local bays.

Perhaps the tastiest of the marine bivalves, bay scallops have been a favorite seafood for people, especially along the eastern seaboard. The only part eaten is their single large muscle. As the muscles appear in markets, they are nearly white, nearly an inch (25 mm) in diameter and a little over an inch (30 mm) long, with flat ends (Fig. 2). Women have liked eating them in part because their meat is white and various additional organs are absent in servings (Anonymous, 1895). Since



Figure 1.—The distribution of bay scallops, *Argopecten irradians* spp., is from Cape Cod, Mass., to the mid coast of eastern Mexico.

the muscle is the only part eaten, there have been few problems with consumers becoming ill from bacterial or viral diseases. Besides, the scallops were handled in the coolest months when the bacteria and viruses are scarce. The remaining organs (the "guts" or "rims") of bay scallops are edible and tasty, but some are nearly black and have such an unappetizing appearance they are rarely eaten.

Ingersoll (1887) wrote, "Bay scallops possess an indefinable lusciousness not possessed by any fish or fruit, yet approximating a combination of them all. They are good boiled and pickled,

Table 1.—Average commercial landings/yr during the 1950's of oysters, northern quahogs, bay scallops, and softshell clams from Massachusetts to North Carolina (NMFS landings statistics).

Species	Bushels	Landed value (\$)
Eastern oysters	9,137,000	23,870,000
Northern quahogs	1,606,000	6,900,000
Bay scallops	222,000	1,150,000
Softshell clams	156,000	1,070,000

but much better fried; many, however, do not like their particular sweetness, which is something like the flavor of a fried softshell clam, but much more cloying and satisfactory. When broiled and stuffed with forcemeat and served in

their own shells, they form an ornament on the table." Parloa (1882), an author of cookbooks in the late 1800's, noted that bay scallops were not quite as popular as clams because their taste was too sweet and strong.

Bay scallops are comprised of three subspecies over their range. The northern bay scallop, *Argopecten irradians irradians*, ranges from Cape Cod, Mass., to New Jersey where it intergrades between New Jersey and Maryland with the southern bay scallop, *A. i. concentricus* (Clarke, 1965; Waller, 1991), which lives from there down the south Atlantic Coast, around Florida, and westward to the Mississippi Delta. The valves of *A. i. concentricus* are more convex and are thicker and harder than those of *A. i. irradians*. The third subspecies, the Gulf bay scallop, *A. i. amplicostatus*, ranges from the Mississippi Delta to the mid coast of México (Broom, 1976).

Each subspecies lives for about 18–30 months. Just two year classes, the adults and the seed (juveniles), are present in the beds.¹ Annual recruitment of juveniles is highly variable, and thus the abundances and landings of market-sized bay scallops have been highly variable from year to year in each of the various bays (Belding, 1910; Blake and Shumway, 2006). Bay scallops inhabit beds of hard sand in the bays from Cape Cod through Barnegat Bay, N.J., and in North Carolina the bed sediments are firm mud. Scallops are most abundant in grass meadows, especially eelgrass, *Zostera marina*, in the northeast, but they can be found on bottoms free of grasses.

Commercial-scale harvests of bay scallops began later than the harvests of oysters and clams, mainly because they inhabit deeper waters, 3–15 ft (1–5 m), and were not as available to fishermen as the others were along bay shores. During the late 1850's, their harvests on a commercial scale began to become established, though slowly at first, when the infrastructure associated with oyster

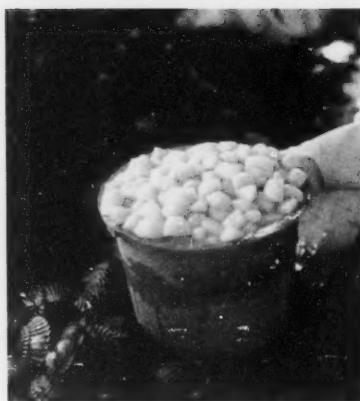


Figure 2.—The white adductor muscles in a plastic pan after the scallops were opened in eastern Long Island, N.Y. Photograph courtesy of Debra Barnes, New York State DEC.

and northern quahog fisheries was being developed. Railroad lines were expanding then, passing by seaside towns, where fish sellers could load and ship bivalves on trains heading to population centers. The natural ice industry developed a couple of decades later, and it provided ice to preserve the bivalves during railroad transits (Jones, 1984).

Bay scallops from Cape Cod through Long Island, N.Y., have been harvested in tightly-regulated seasons that ran from fall and winter through March, a time when the adult scallops had already attained their full growth and, due to the cold water, were nearly dormant on the bottom. This makes them easier to harvest than if they were active because they can swim away from harvesting gear in warm water. The legal season in North Carolina is from December or January into May. The seasons everywhere often lasted 2–8 weeks for most fishermen, because the bulk of the season's scallop crop was harvested by then. In the seasons when the scallops were in high abundance, as much as 10–50% of the labor force in some of the smallest coastal towns was employed in the fishery, mostly as fishermen and openers, and at least 1,000 fishermen in Massachusetts and 300–500 in both New York and North Carolina harvested bay scallops. The harvests brought the



Figure 3.—The fishermen are happy at the beginning of a good season, mainly because their earnings are good, Katama Bay, Edgartown, Martha's Vineyard, Mass., 1950. Photograph by C.L. MacKenzie, Jr.

fishermen their highest weekly earnings of the year (Fig. 3), as the monetary return per unit of their effort was high. The scallops also have been harvested as a recreational pastime especially in recent decades in some states including Florida.

The overall range of the bay scallop fishery is not continuous. The coastal environments of South Carolina and Georgia are not suitable for supporting many scallops. The west coast of Florida had a limited commercial fishery for bay scallops until they became too scarce in the early 1990's. Florida then prohibited further commercial harvesting and promoted recreational harvesting, which has been popular for tourists (Fig. 4). Along the Gulf Coast from Alabama into Mexico, bay scallops were harvested to a limited extent only in Texas and northeastern Mexico. Separate articles on those states are listed below.

Since 1985, bay scallop abundances and landings have fallen sharply, and in the 2000's commercial fisheries for them barely exist in many once-productive bays (Fig. 5). Commercial bay scallop fisheries of some magnitude exist only in a few places, such as on Martha's Vineyard and Nantucket, Mass., and even they have had sharp declines. Some papers in this series will attempt

¹Conant, K. L., and T. L. Curley. 2006. Nantucket nub scallops, *Argopecten irradians*, overwinter twice and spawn for the first time at 21–22 months of age. Unpubl. Rep. Mar. Coastal Resour. Dept., Nantucket, Mass., 25 p.

to explain the reasons for the declines. The abundance of bay scallops may be an indicator of the abundances of the other species of invertebrates that also occupy the same bays. Will the bay scallop fisheries return to their former sizes? The answer lies in whether the quality of habitats improves to support more scallops.

The Scallop use in Ancient History

The design of the scallop shell has been used as a decoration and symbol since ancient times. In 1957, the Shell Transport Company, LTD, published a 135-page book titled, "The Scallop, Studies of a Shell and its Influences on Humankind," as a celebration of the company's Diamond Jubilee (Cox, 1957). Of the book's eight chapters, five discuss the shell as a decoration and symbol. The remaining chapters describe the general nature of the scallop, its biology, and its use as a food. The chapters on the use of its shell over several centuries are described below.

A Symbol in Ancient Times, by Mortimer Wheeler

The art of the ancient world is strewn with scallop shells. A myriad of scallop motifs appear in Hellenistic and Roman terra-cotta, metalwork, painting and carving. One example is a long series of representations of the birth of Aphrodite (Venus) from a shell. The earliest known example of the architectural use of the scallop shell motif is dated by an inscription to the year 87 B.C.

The scallop motif was used to illustrate a wide range of art between the 4th century and the 5th or 6th century A.D. in lands included within the Roman Empire. Many flasks and other vessels of earthenware or glass sometimes assumed the form of the scallop. It also decorated Roman gravestones and coffins.

The Badge of St. James, by Christopher Hohler

St. James, in life, was a fisherman and one of the 12 apostles. After the death of Jesus Christ, St. James undertook the evangelization of Spain. In death, he became the patron saint of Spain and



Figure 4.—Family and friends harvesting bay scallops in the wading waters of St. Joseph Bay, Fla. Photograph courtesy of Port St. Joe Dept. of Commerce.

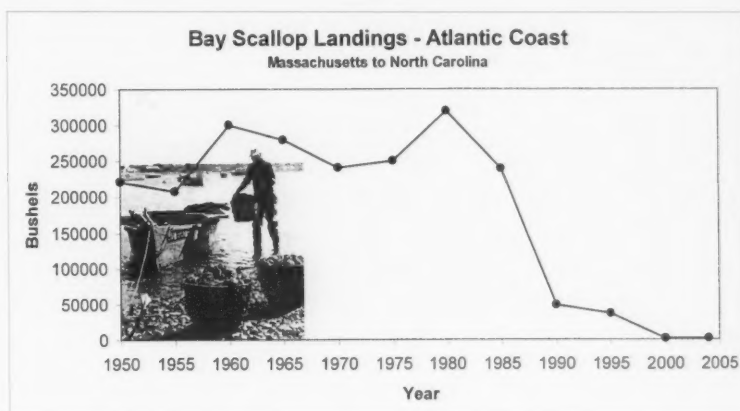


Figure 5.—The landings of bay scallops, *Argopecten irradians irradians* and *A. i. concentricus*, Massachusetts to North Carolina. Insert, landing bay scallops in Fairhaven, Mass., early 1950's.

also of religious pilgrims, and the scallop shell was his symbol. Religious pilgrims traveling to the shrine at Santiago de Compostela where he was buried wore the scallop shell motif on their hats; the first sign of this was in about 1130 A.D. It was a mark of devotion and it signified that the pilgrims had really traveled to the shrine. Pilgrimages to the shrine have been made from distant points in Europe. The scallop shell motif

in every statue, painting, stain-glass window shows that St. James represents an invitation to visit his grave.

The Cradle of Venus, by James Laver

With the Renaissance in Europe (1300's–1600's), the scallop symbol became a decorative motif to be used without any special significance. The most famous of the representations is

Botticelli's Birth of Venus. The use of the shell design became commonplace in painting and in architecture and was used in the minor decorative arts all over Europe. Commonly used as a background in fountains, it was imitated in precious metals and used as a decorative motif.

Escallops in Armory, by George Bellew

Depictions of scallop shells have occurred in armorial bearings since the beginning of heraldry. The earliest ones appear on seals and in rolls of arms about 700–800 years ago. Since then, they have consistently occupied a prominent place. Various fraternities of knights and orders of chivalry used scallop shells as a badge in various ways. In heraldry, the scallop shell is nearly always depicted with the beak (open end) uppermost. This may be because it was commonly seen in that position attached to the uppermost raiment of pilgrims.

An Excursion into the Americas, by Adrian Digby

The scallop shell was used on drawings and vases by the Native Americans of South and Central America. From the earliest times and in isolation from Europe, they derived much of the same sort of stimulation from the scallop as did their contemporaries in the Old World. In modern times, the scallop shell design is used to decorate a broad range of objects including store signs, napkins, and gravestones.

Scope of This Treatise

Parts I and II cover the bay scallop, *Argopecten irradians* spp., over its entire range along the east coast of North America from the Canadian Maritimes to the mid coast of Mexico. Descriptions of its biology, autecology, scallop usages by Native Americans, a history of its fishery, insults to the scallops' environments, and restoration efforts are included. A paper on eelgrass describes its role as an extremely important component of the bay scallop habitat, and another on geomorphology describes how the inlets and bottom

morphologies of bay scallop estuaries have changed through time. When inlets have widened, scallops usually have become more abundant and vice versa. The final paper describes the history of the Massachusetts shellfish officers (wardens) service. A Shellfish Officer Service exists in all coastal states and it has the primary goal of conserving the shellfish stocks and abundances. Its history in this series is the first to be written. Papers on some other habitat components that likely have a substantial role in governing abundances of bay scallops, i.e. water chemistry, phytoplankton, and such predators as crustaceans and finfishes could not be included due to a lack of specific information on their relationships to scallop populations. Altogether seven papers are included, each written by scientists with expert knowledge gained over a long experience with studies of the subjects they cover.

Paper 1.—The Bay Scallop, *Argopecten irradians*, Massachusetts Through North Carolina: Its Biology and the History of Its Habitats and Fisheries, by Clyde L. MacKenzie, Jr.

This paper covers the bay scallop fishery from Massachusetts through North Carolina, the principal harvesting area. The biology and habitats of bay scallops, descriptions of improvements in historical harvesting gears, historical landings and fisheries in each state, and many photographs of the gear, harvesting, and processing are included. The sharp declines in scallop landings after the early 1980's and efforts to restore the bay scallops are also described.

Paper 2.—The Bay Scallop, *Argopecten irradians*, in Florida Coastal Waters, by William S. Arnold

The historical importance of the bay scallop as a commercial and recreational shellfish in Florida coastal waters is described. A review of the biology and habitats of bay scallops, the declines in abundance, and the efforts to restore the scallop populations are included.

Paper 3.—Bay Scallops, *Argopecten irradians concentricus* and *A. i. ampli-*

***costatus*, in the Northwestern Gulf of Mexico (Alabama, Mississippi, Louisiana, and Texas), by Kim Withers and Matt Hubner**

Scallops, *Argopecten irradians amplicostatus*, here are widely distributed but too scarce to support fisheries nowadays. This paper emphasizes the presence of bay scallop shells in Indian shell middens in Texas, and describes brown tides along the coast of the U.S. Gulf of Mexico.

Paper 4.—The Bay Scallop, *Argopecten irradians amplicostatus*, in Northeastern Mexico, by Armando T. Wakida-Kusunoki

Though not plentiful here, the distribution of the bay scallop, *Argopecten irradians amplicostatus*, and its habitat in northeastern Mexico are described. The paper also includes usage by prehistoric Indians and current harvesting methods and markets of the bay scallops.

Paper 5.—Eelgrass, *Zostera marina*, as Bay Scallop Habitat, by Mark S. Fonseca and Amy V. Uhrin

The biology of eelgrass including its life history, seasonal growth cycle, and adaptation to its habitat, and the relationship of bay scallops to eelgrass meadows are described. In addition, the historical distribution of eelgrass, the effects of the wasting disease in the 1930's, and efforts to restore depleted eelgrass meadows are included.

Paper 6.—The Changing Geomorphology of Estuarine Inlets, Atlantic Coast of the United States, by Norbert Psuty and Tanya Mendes Silveira

The sizes and shapes of inlets and sand bars in bay scalloping bays have played a huge role in the sizes of scallop crops that the bays can support. The paper provides examples of how the inlets and sand bars have been modified through history.

Paper 7.—History of the Shellfish Officer Service in Massachusetts, by Henry Lind

The Shellfish Officer Service in each coastal state has the important role of

enforcing conservation rules and carrying out some shellfish restoration practices. The officers in Massachusetts oversee fishermen's catches of bay scallops, quahogs, softshell clams, and oysters.

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The Bay Scallop, *Argopecten irradians*, Massachusetts Through North Carolina: Its Biology and the History of Its Habitats and Fisheries

CLYDE L. MACKENZIE, Jr.

Introduction

The major harvesting area for bay scallops, *Argopecten irradians irradians* and *Argopecten irradians concentricus*, in eastern North America has been coastal bays from Massachusetts through Long Island, N.Y., and in North Carolina (Fig. 1). From the 1870's to the mid 1980's, the fishery was important economically and culturally to com-

munities on the shores of southern Cape Cod, Buzzards Bay, and the islands of Martha's Vineyard and Nantucket in Massachusetts; Peconic Bay in eastern Long Island, N.Y.; and Bogue and Core Sounds, N.C. At times in the past, smaller bay scallop fisheries existed in Rhode Island, Connecticut, New Jersey, and Virginia.

In the years of large landings, the fishery provided local communities with considerable economic vitality in the fall and winter when business activity was often otherwise slow. Bay scallop landings over this range averaged nearly 300,000 bushels of live scallops/year

from 1950 to 1985, but only about 40,000 bu/yr from 1986 to 2005 because the abundance of scallops declined sharply after 1985. A bushel of scallops in Massachusetts and New York contains about 350 scallops that yields about 6 pounds of meats (adductor muscles). A bushel of scallops in North Carolina contains about 250 scallops that yields about 5 pounds of meats.

This paper includes a review of the biology, autecology, and habitats of the bay scallops, *Argopecten irradians irradians* and *A. i. concentricus*, a description of scalloping gear and uses,

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ABSTRACT—This article covers the biology and the history of the bay scallop habitats and fishery from Massachusetts to North Carolina. The scallop species that ranges from Massachusetts to New York is *Argopecten irradians irradians*. In New Jersey, this species grades into *A. i. concentricus*, which then ranges from Maryland through North Carolina. Bay scallops inhabit broad, shallow bays usually containing eelgrass meadows, an important component in their habitat. Eelgrass appears to be a factor in the production of scallop larvae and also the protection of juveniles, especially, from predation. Bay scallops spawn during the warm months and live for 18–30 months. Only two generations of scallops are present at any time. The abundances of each vary widely among bays and years.

Scallops were harvested along with other mollusks on a small scale by Native Americans. During most of the 1800's, people of European descent gathered them at wading depths or from beaches where storms had washed them ashore. Scallop shells were also and continue to be commonly used in ornaments.

Some fishing for bay scallops began in the 1850's and 1860's, when the A-frame

dredge became available and markets were being developed for the large, white, tasty scallop adductor muscles, and by the 1870's commercial-scale fishing was underway. This has always been a cold-season fishery: scallops achieve full size by late fall, and the eyes or hearts (adductor muscles) remain preserved in the cold weather while enroute by trains and trucks to city markets.

The first boats used were sailing catboats and sloops in New England and New York. To a lesser extent, scallops probably were also harvested by using push nets, picking them up with scoop nets, and anchor-roading. In the 1910's and 1920's, the sails on catboats were replaced with gasoline engines. By the mid 1940's, outboard motors became more available and with them the numbers of fishermen increased. The increases consisted of part-timers who took leaves of 2–4 weeks from their regular jobs to earn extra money. In the years when scallops were abundant on local beds, the fishery employed as many as 10–50% of the towns' workforces for a month or two. As scallops are a higher-priced commodity, the fishery could bring a substantial amount of money into the local economies.

Massachusetts was the leading state in scallop landings. In the early 1980's, its annual landings averaged about 190,000 bu/yr, while New York and North Carolina each landed about 45,000 bu/yr. Landings in the other states in earlier years were much smaller than in these three states. Bay scallop landings from Massachusetts to New York have fallen sharply since 1985, when a picoplankton, termed "brown tide," bloomed densely and killed most scallops as well as extensive meadows of eelgrass. The landings have remained low, large meadows of eelgrass have declined in size, apparently the species of phytoplankton the scallops use as food has changed in composition and in seasonal abundance, and the abundances of predators have increased. The North Carolina landings have fallen since cow-nose rays, *Rhinoptera bonasus*, became abundant and consumed most scallops every year before the fishermen could harvest them. The only areas where the scallop fishery remains consistently viable, though smaller by 60–70%, are Martha's Vineyard, Nantucket, Mass., and inside the coastal inlets in southwestern Long Island, N.Y.

the characteristics of the fishery including marketing, a history of each state's fishery and landings, the environmental changes in the habitats during and since the 1980's, and attempts made to restore the fisheries and landings. A description of the habitats provides some details on how the recent rises in temperature and pollution are affecting aquatic environments. Besides bay scallops and other commercial bivalves, the habitats are nursery and feeding areas for coastal and oceanic fishes besides a wide variety of other biota. Most biological and ecological information described relates to *A. i. irradians* from Massachusetts to New York. A substantial amount of the information reported here was collected from personal observations and from interviews of long-time bay scallop fishermen, town shellfish officers, and state shellfish resource management personnel. The names of the principal informants are listed in the footnotes. The landings data are assumed to be a rough reflection of the abundance of bay scallops in each locality, because the fishermen have consistently harvested nearly all the older year class of scallops in bays each year throughout the history of the fishery.

Biology and Ecology

Bay scallops are distributed widely over the bottoms of bays and harbors. Adult scallops are spaced randomly at least 2–6 in (5–15 cm) and usually much further apart from one another. They lie flat, unless lodged among dense grasses, usually eelgrass blades. Adults do not attach to one another or to any substrates. Individuals are oriented in different directions, rather than perhaps toward or against the water current, and each commonly lies in a slight depression, perhaps 0.3 in (1 cm) deep in the sand sediment. The scallops can be concentrated in shallow channels, but they are absent on both intertidal and extremely shallow sand bars.

The following description of the biology of the bay scallop is quoted almost entirely from the outstanding report on the bay scallop of Massachusetts written by D. L. Belding and published in 1910. The report contains a description of its

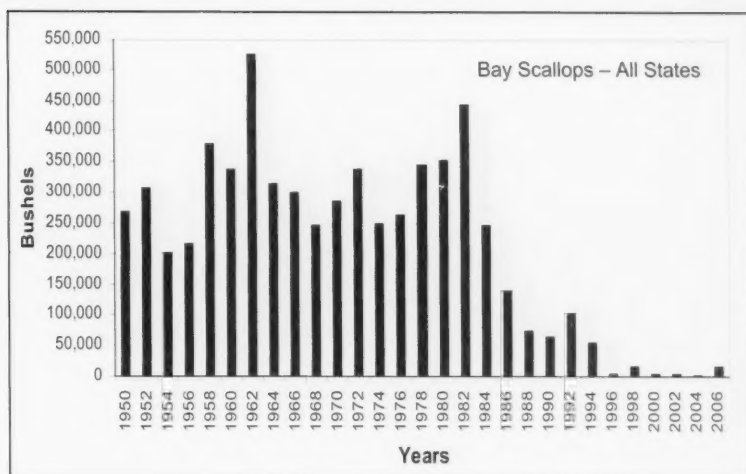


Figure 1.—Total landings of bay scallops, all states from Massachusetts to North Carolina, 1950–2006. Source: NMFS Landings Statistics.

shell and anatomy of its soft parts, mode of reproduction, feeding, and growth in the region from Massachusetts to Long Island, N.Y. It will not be otherwise cited in this section; only additional material will be cited. Descriptions of the biology and ecology of *A. i. concentricus* are also included.

Shell and Growth Line

The bay scallop has two valves (shells) that are nearly round. They are joined on a straight hinge line by a thin ligament. The lower valve on which the scallop rests on the bottom has a paler color, is more convex, and also differs from the upper in having a byssal notch. The valves are slightly wider than long. The northern bay scallop, *Argopecten irradians irradians*, is slightly smaller and is lighter in weight than the southern scallop, *Argopecten irradians concentricus*.

The average dimensions of a fully grown adult northern scallop (from Martha's Vineyard) are: length, 2.4 in (6 cm); width, 2.5 in (6.6 cm); thickness of whole scallops, 1.1 in (2.8 cm). The average weight of an individual valve is 11 grams. The average dimensions of a fully grown adult southern scallop (from Bogue Sound, N.C.) are: length, 2.7 in (7.2 cm); width, 2.9 in (7.6 cm);

thickness of whole scallop, 1.5 in (3.7 cm); the average weight of a valve is 21.3 grams (Fig. 2). The valve hinge lines of both are straight to the end of well-developed "ears."

The outer surface of the shell of *A. i. irradians* has prominent ridges and furrows that radiate from the beak to the margin. Not counting those that extend onto the "ears," they number from 14 to 19 in different scallops, young and old, the average being 16. The furrows fit closely together at the margin when the valves close. Crossing the radiating ridges are thin concentric growth lines. Growth ceases during winter, and when it resumes again in spring a distinct growth line is formed by the thickened edge of the shell (Fig. 3). The presence of this growth line defines an adult scallop, according to regulations in the states. The scallop then is about 10 months old. The location of this line usually is 1.15–1.5 in (30–40 mm) from the hinge, but it varies between 0.4 and 2.5 in (10–65 mm), depending upon the size of the scallop when it ceases growing in the fall.

The inner shell surface is smooth and somewhat vitreous. Ridges and furrows exist, but they are not as conspicuous. The scallops' eyes are located near the outer edge of each valve.

The light shell is suitable for movement through the water, and its rounded thin form offers the least resistance for swimming. When the scallop swims, streams of water are forced by the aid of the mantle through small openings in the mantle near the "ears." The two subspecies, *Argopecten irradians irradians* and *Argopecten irradians concentricus* swim using the same method.

Internal Organs

The inner side of the bay scallop's valves is lined with a thin ciliated mantle that is attached to other living tissues (Fig. 4, 5a, b). Its free edge possesses numerous guard tentacles or tactile organs and blue bead-like eyes (Fig. 6a, b). The margins of the mantle are thickened lobes. When the scallop is resting, the lobes are held slightly apart. The mantle secretes shell and ligament and is also involved in water circulation and particle movement within the pallial cavity. Beninger and Le Pennec (1991) believe the mantle may be a site for the exchange of gases.

The guard tentacles vary in size and form and have a sensory function. When the scallops lie undisturbed, the tentacles lengthen and wave slowly in the water

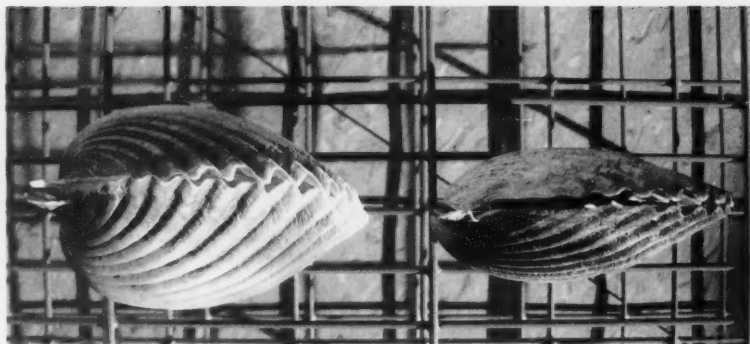


Figure 2.—The southern bay scallop (left) (this one from Bogue Sound, N.C.) is larger than the northern bay scallop (right) (this one from Martha's Vineyard, Mass.). Note: All photographs in this paper are by C. L. MacKenzie, Jr. unless otherwise credited.

currents. The bay scallop eyes, blue and about one-fifteenth of an inch (1–1.5 mm) in diameter, are at the tips of short stalks which extend outward from the middle fold of the mantle lining the circumference of the valves and are among the tentacles; each usually is located within one of the furrows of the shell. The eyes, found in association with both the upper and lower valves, can detect movements in the environment at distances greater than required to cast a shadow. The guard tentacles

will be withdrawn immediately at the passing of a shadow or at any slight disturbance (Wilkens, 1991). Bay scallops also appear to have an olfactory sense, because they swim away from starfish, *Asterias forbesi*, placed near them.

The adductor muscle (called the "eye," or "heart" in the fishery) is posterior to the center of the shell, and consists of a large anterior section and a smaller posterior section (Fig. 7a, b). This posterior section is tougher for a person to chew than the anterior section. When the muscle is cut from a valve, the valves immediately gape open, being forced apart by a V-shaped cartilaginous elastic pad in the middle of the hinge.

Toward the hinge of an adult scallop is a small muscular foot extending from the

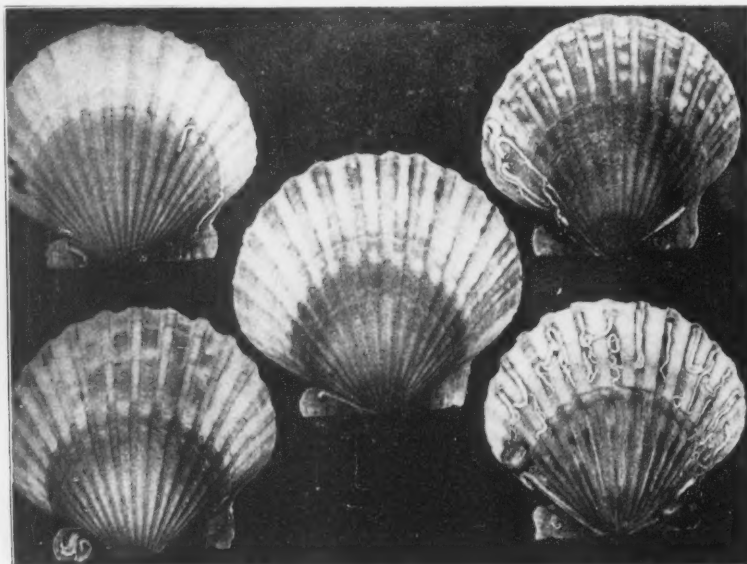


Figure 3.—Fully-grown northern bay scallops usually have a distinct growth mark on their shells (Belding, 1910).

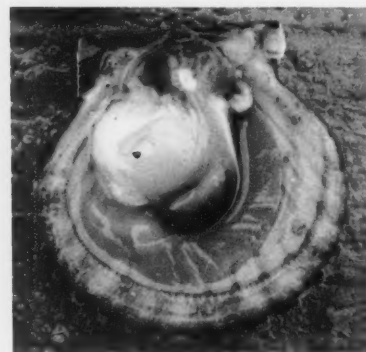


Figure 4.—A fully-grown northern bay scallop from Cape Poge Pond, Martha's Vineyard, Mass., with its upper valve removed.

upper part of the visceral mass dorsally for about a quarter of an inch (8 mm). A byssal gland, on the proximal end of the foot, secretes a bundle of threads, termed the byssus by which the juvenile scallop anchors itself to an object.

Reproduction

Male and female reproductive organs are found in each adult bay scallop. The testis usually is cream-colored and lies just ventral to the digestive gland and foot and extends down the side of the ovary, which during the spawning season becomes bright orange. The gonad's surface is nearly solid black during some months. The ovary is larger than the testis. During the early part of the spawning season when the testis and ovary are full of spermatozoa and eggs, the reproductive organs are well-rounded. After completion of spawning, they become smaller and paler.

In the early part of the spring, the sex products begin to ripen. Once gametogenic maturity is reached, the most important stimulus for spawning is temperature (Barber and Blake, 2006). Sastry (1966) reported that in *A. i. concentricus*, gonad growth is timed to when phytoplankton is most abundant, so the scallops can accumulate reserves in the body for maintenance and growth of the gonads, and also food is available for the scallop larvae. Photoperiod also may influence reproduction. Laboratory experiments showed that an increase in reproduction condition (ripeness) will occur when the daily light hours are increased each day while the temperature is maintained constant. This observation has been made in *A. i. irradians* and other scallops (Couturier and Aiken, 1989; Devauchelle and Mingaut, 1991; Paulet and Boucher, 1991; Villalejo-Fuerte and Ochoa-Baez, 1993; Saout et al., 1999; Desantis et al., 2006).

The final ripening of *A. i. irradians* takes place during May, when the water temperature has reached 45.5°–50°F (7.5°–10°C), and the scallop is prepared to spawn during the first part of June (also cited in Bricelj et al., 1987). The spawning season lasts from mid June to mid August; the greater part of the spawning may be at any time during this

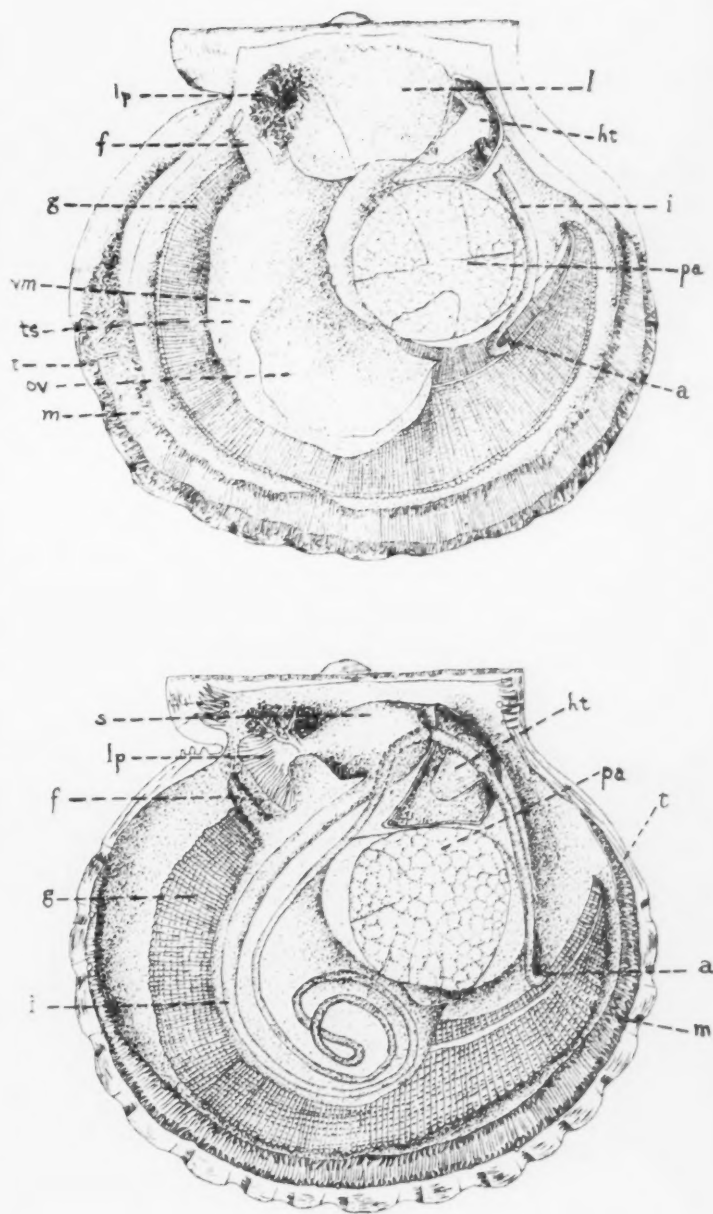


Figure 5a, b.—The internal organs of the northern bay scallop, *Argopecten irradians*. Upper figure with left valve, mantle, and gills removed. Lower figure shows the digestive system: s—stomach, lp—palps, f—foot, g—gills, i—intestine, ht—heart, pa—posterior adductor muscle, t—tentacles, a—anus, m—mantle, vm—visceral mass, ts—testis, ov—ovary, and l—digestive gland (from Belding, 1910).



Figure 6a.—When a fully-grown northern bay scallop opens its two valves widely, its eyes, gonad, mantle, adductor muscle, and anus are visible.

period (Fig. 8). Though not documented, bay scallops probably behave similarly to oysters, *Crassostrea virginica*, to maximize fertilization of their eggs. In the oyster, males initiate the spawning of females by releasing sperm into the water. Females draw in the sperm and this triggers them to release eggs immediately into the water to mix with the sperm for fertilization (Galtsoff, 1964). If so in bay scallops, the male portion of their organ would spawn and then other scallops take in the sperm and the female portions of their gonads would spawn. Each scallop probably spawns a few million eggs a season. Year-class success apparently depends upon the numbers of sperm and eggs produced (Barber and Blake, 2006), fertilization success, and survival of the larvae and juveniles.



Figure 7a.—The northern bay scallop, *Argopecten irradians irradians*. (This one from Cape Poge Pond, Martha's Vineyard) has a large adductor muscle.

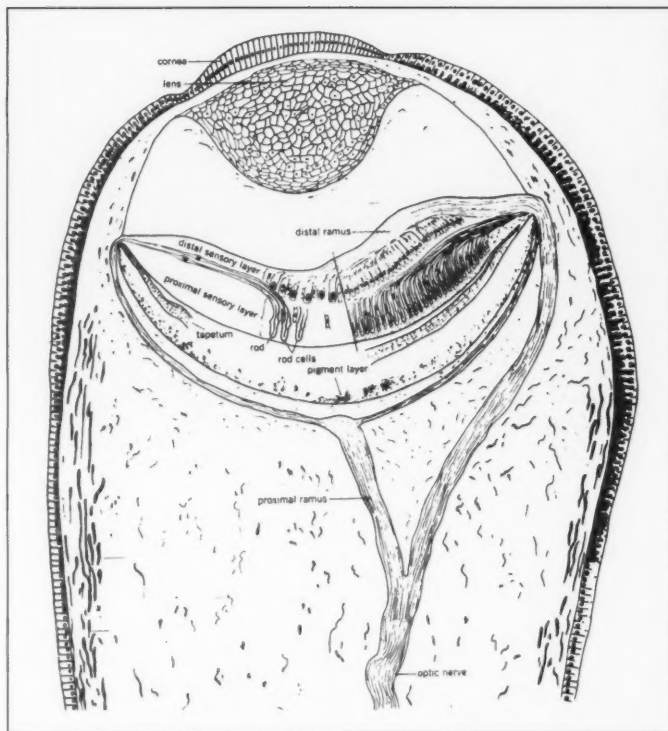


Figure 6b.—Diagram of the scallop (*Pecten*) eye (from Bullock and Horridge, 1965)

Pennington (1985) has made some observations of the sea urchin, *Strongylocentrotus droebachiensis*, that may have direct application to bay scallops. He found that when the urchins spawn, their sperm becomes exhausted quickly. The sperm lost potency so rapidly that less than 10% fertilization resulted

when 20-minute-old sperm were added to fresh eggs. Thus, the urchins' sperm must fertilize eggs minutes after they are spawned or they will not have the capacity to fertilize them. He suggested that adult urchins probably group together and then spawn synchronously, so their sperm and eggs will be concentrated and result in a relatively high fertilization rate. Egg fertilization would be far less successful if the adults were spaced far apart, especially if their sex products were scattered by currents.

Future tests involving bay scallops may show that when adults spawn within eelgrass meadows their sperm remains concentrated and has a good chance of being detected in sufficient quantity by other scallops to stimulate them to spawn eggs and more sperm. If the sperm were released on otherwise plain bottoms, it is more likely to be so scattered and its concentration so diluted that fewer scallops could detect it and



Figure 7b.—The southern bay scallop, *Argopecten irradians concentricus*. (This one from Bogue Sound, N.C.) has a longer, but narrower adductor muscle than the northern bay scallop.

spawn. Moreover, a mass spawning by a given number of adults within the meadows would likely result in a higher rate of fertilization than a spawning on plain bottoms because the sperm and eggs would remain close together.

The fertilized eggs develop into free-swimming larvae that feed and respire as they grow. After about 14 days, the larvae settle and attach to substrates, such as eelgrass (Fig. 9a). Where eelgrass is absent, other surfaces provide a substrate for bay scallop larvae to attach, but they do not offer the small scallops the cover protection that eelgrass offers. The alternate surfaces include pebbles and stones (Fig. 9b); the shells of dead scallops, mussels, and common Atlantic slippersnails (quarter-decks), *Crepidula fornicata*; glass bottles; concrete blocks; and, since the late 1950's, codium, *Codium fragile*, that was introduced to U.S. waters (Fig. 10). Codium is a dark green siphonous alga. In the fishery, it now goes by its generic name, but has also been called "dead man's fingers" and "sponge weed."

The larvae of *A. i. irradians* in eastern Long Island are 150–190 μ long when they attach to substrates (Tuttlebach, 1986; Eckman, 1987). The optimal temperature for growth and survival of *A. i. irradians* larvae lies between 68° and 86°F (20°–30°C), and the optimal salinity lies between 20‰ and 30‰. Scallops grow well at constant temperatures of 59°F (15°C) and at 90°F (30°C), but not at 50°F (10°C), and they do not survive a temperature of 95°F (35°C). They also do not survive a salinity of 10‰ (Tuttlebach and Rhodes, 1981).

In a study conducted on Long Island, N.Y., in the 1990's, Tuttlebach et al. (1999) reported on the spawning of bay scallops in late September, October, and maybe even early November following an earlier June/early July spawning. Then, Conant¹, in a study in 2000 and 2001, described a similar fall (September) spawning in Nantucket Harbor. A similar fall spawning also occurs in Cape Poge Pond, Martha's Vineyard.

¹Conant, K. L. Biologist, Nantucket Marine and Coastal Resources Department, Personal commun., 2006.

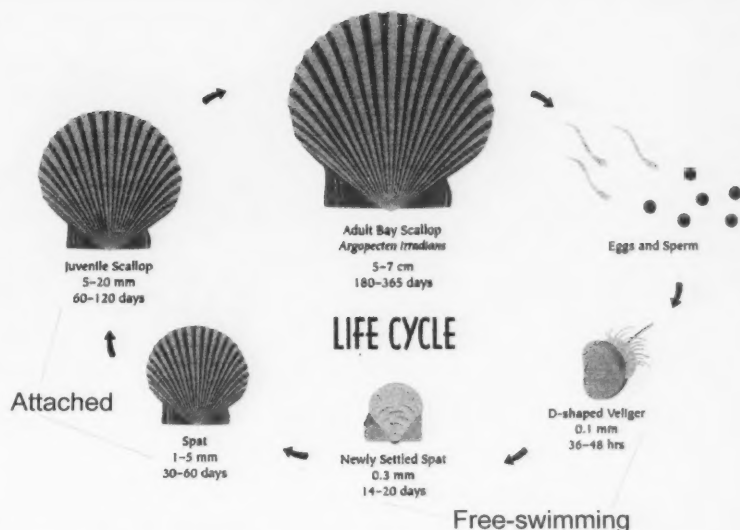


Figure 8.—A sketch of the life cycle of bay scallops (from N.C. Fisheries Management Plan—Bay Scallops, 2007).

Referred to as "nubs" in Nantucket, the juvenile fall recruits pass through the winter at 0.2–0.8 in (5–20 mm) long, and in spring have a growth line on their shells a distance of 0.2–0.8 in from their umbos, rather than the 1.2–1.6 in (30–40 mm) distance that Belding (1910) had reported for bay scallops on southern Cape Cod.

The biology of *A. i. concentricus* is somewhat similar to *A. i. irradians*. As noted, *A. i. irradians* in the northeast spawns mostly in the spring, but *A. i. concentricus* in North Carolina spawns mostly in the fall (Bishop et al., 2005). The North Carolina fishermen and biologists notice the juvenile scallops ("spawns") in April but not before. They believe there is some spawning in the spring and most is in the fall (Smith²).

Erratic Annual Quantities

The quantities of bay scallop seed (juveniles) and subsequently market-sized scallops produced in various bays has varied widely from year to year, ranging from small, to medium, to large. The seed quantities bear little

relationship to the quantities of adult scallops present that had spawned them. The principal controlling factors are: 1) production of the number of larvae by the adults (this is discussed below in Bay Scallop Habitat), 2) survival of larvae while swimming, feeding, and growing in the water to setting size for roughly two weeks, and 3) survival of the post-set juveniles from the time they set and attach to substrates to a size of perhaps 10–12 mm when most release themselves from substrates.

Survival of the swimming larvae probably depends mostly upon the quantities and species of phytoplankton available for them and also water temperature and predation. In bivalve hatcheries, workers have found that bay scallop larvae will grow only when fed specific species of phytoplankton. In contrast, the larvae of oysters and northern quahogs, *Mercenaria mercenaria*, will grow when fed a far wider range of species. Various scientific studies have shown that the presence of various phytoplankton species in natural waters is highly variable, by hour, by day, by week, by season, and by year. Their variability is commonplace: species populations often appear

²Smith, N. Shellfisherman, Salter Path, N.C., Personal commun., 2004.

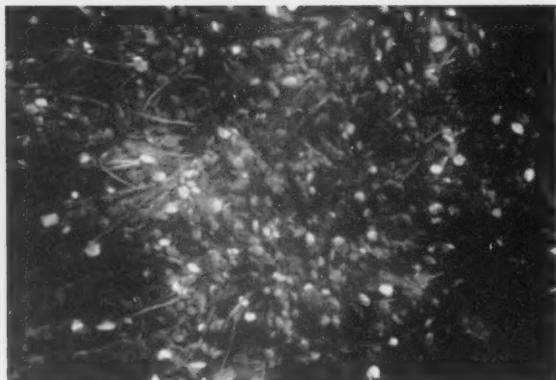


Figure 9a.—A large mass of juvenile seed bay scallops attached to eelgrass blades, Lagoon Pond, Martha's Vineyard, Mass. Photograph by David Grunden.

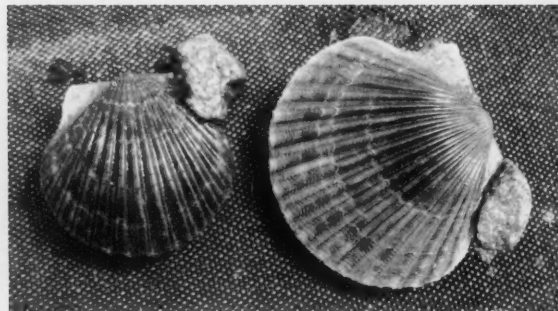


Figure 9b.—Northern bay scallop seed attached to small stones, Cape Poge Pond, Martha's Vineyard, Mass.

and disappear within a week; groups of various species replace each other; and the biomass levels and blooms vary widely by season and by year. The fluctuations can be caused by temperature, cloud cover, nutrients, grazing by zooplankton, and probably additional factors (Veldhuis et al., 1997; Gaard et al., 1998; Smayda, 1998; Thompson, 2001; Thomas et al., 2003; Dagg et al., 2006; Smetacek and Cloern, 2008). Such an irregular pattern of species occurrences suggests that the foods that bay scallop larvae require for survival are only sporadically present.

Little study has been made of the mortalities of bay scallops in the beds, except for noticing small scallop seed in the stomachs of scup and probably other fish and ducks. Most mortalities in bivalves occur in the post-set juveniles, and they are caused by juvenile and adult predators. Studies in Europe have shown that predation rates by the shrimp, *Crangon crangon*, on recently-set bivalves can be high and they have been increasing in recent decades probably due to the warming trend. *Crangon crangon* can consume at least 90% of juvenile bivalves (<0.3 mm long). The

numbers of shrimp and their destruction of bivalves vary among years (Van der Veer et al., 1998; Beukema and Dekker, 2005). MacKenzie (1981) reported that mortality rates of juvenile eastern oysters caused by predators in Connecticut can be nearly 100%, but the predation rate is highly variable among years and oyster beds. Loosanoff (1964) provided evidence that predation rates on juvenile bivalves varies each year when he showed that annual occurrences of the predacious juvenile starfish in Connecticut ranged widely over a 25-yr period.

Growth

Bay scallops have two periods of growth corresponding to the summers of their lives, and two resting periods during their winters. Their sedentary life begins when the swimming larvae attach to substrates in July or shortly thereafter, and they grow rapidly, often 10 mm/month. Growth ceases in December and is again resumed around 1 May of the following year, when the water temperature has reached 45°–50°F (7.2°–10°C). The same scallop ceases growth in the fall, usually in the latter part of November, slightly earlier than the young set of that year, when the water has again fallen below 45°F. The growth rate slows during the spawning period; the scallop grows twice as fast in May and August through October as it does in June and July. Scallops in eelgrass meadows grow more slowly than those on plain bottom where water cur-

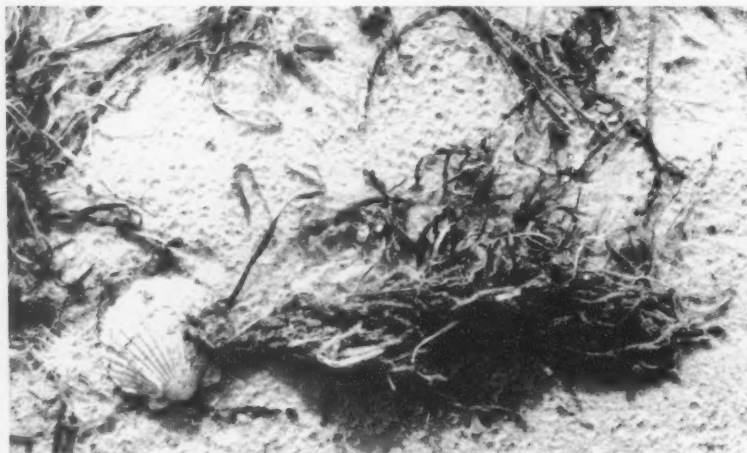


Figure 10.—Codium, *Codium fragile*, a green seaweed, can attach to bay scallops and both can be carried onto beaches during wind storms.

rents are faster. Most scallops die in the late winter and early spring when 24–26 months old. A few scallops live beyond 26 months, and some individuals may reach the age of 36 months (Marshall, 1960; Tettibach, et al., 1999).

Swimming

The act of swimming begins with the bay scallop lying on the bottom, with its guard tentacles extended. The scallop then suddenly folds the tentacles back so that they lie closely against the outer border of the perpendicular mantle. The valves then close by a quick action of the adductor muscle (clap) and water is expelled forcibly, posteriorly, and near one of the "ears." The valves quickly open and clap again. The water is driven out posteriorly again but, this time, near the opposite ear. The scallop makes successive claps, in which the water is driven out from alternate ears, so it swims in a zig-zag line slanting upward to keep moving, and, in shallow water of 3–12 ft (1–4 m), it soon rises to the surface. Not being able to take in any more water by opening its valves, the scallop gives a final squirt and it sinks to the bottom in a new location with its shell closed. The average distance covered in a single swim can be as much as 10 ft (3 m). Scallops can also dart in a dorsal direction; the water is expelled with a quick squirt from the ventral portion of the valves.

Not built for continuous traveling, the bay scallop requires time to rest between each flight, and often many hours elapse between swims for an individual. MacDonald et al. (2006) found that exhaustion was a likely reason the scallops desist in clapping. Repeated valve clapping can be maintained for only a few minutes, and the scallops afterward do not respond to further stimulation and remain with closed valves while they rest.

Long distance travel of bay scallops is possible when external forces, such as storm winds driving strong currents, move them, but this is a matter of chance. Extended and directional movements never occur. A scallop may move to various parts of a bay or harbor, especially if currents are strong.

Feeding

The bay scallop obtains food, principally diatoms (Belding, 1910; Davis and Marshall, 1961), by means of its ciliated gills which consistently beat and move water through the body cavity. The edge of the mantle, when extended, acts as a curtain to close the space between the valves. A pseudosiphon is formed in the curtain with the result that a continuous stream of food-laden water passes through the mantle cavity over and through the gills, which collect the food, and the water goes out in a definite area in the posterior side of the shell. The water stream carries wastes from the anus and gills.

Genetics

Several studies have been conducted on the genetic traits of bay scallops. The following has been reported:

1. The genetics of *A. i. irradians* from New York, Connecticut, and Martha's Vineyard are similar, and they differ from the genetics of North Carolina's *A. i. concentricus* (Xue et al., 1999).
2. Bay scallops (*A. i. irradians*) have excellent responses to selection for improved growth. This could have importance for future hatchery rearing of bay scallops (Stiles et al., 1996).
3. Preliminary results for *A. i. irradians* showed: a) the scallops manifest inbreeding depression in their early stages by decreased survival to the larval stage and to metamorphosis, and by retarded growth of larvae and early juveniles, b) shell marks seem to be reflective of genotypes with a significant genetic component, and c) different inbred lines will have different degrees of fitness to habitats (Stiles and Chomanski, 1995).

Habitat

A sketch of the principal bay scallop habitats was written by Marshall (1960): "The estuaries in which the bay scallop occurs have the following hydrographic features: The basin is relatively shallow

(mostly 3–10 ft, 0.9–3 m), with resulting high ratio of tidal volume to the volume of low water; the circulation is such as to retain the planktonic scallop larvae in sufficient numbers for reseeding and to provide an adequate supply of phytoplankton food, perhaps in part supplied by offshore waters."

The shoreline relief of bays and harbors, though usually low, provides them with some protection from being washed ashore by wind storms (Fig. 11). In the northeast, the bays are commonly 0.5–3 miles (0.8–4.75 km) across, and have fairly level bottoms of firm sand and muddy-sand that contain some shells and pebbles, and also broad eelgrass meadows. The bay waters have temperatures that range from about 64° to 70°F (18°–21°C) during summer and from about 35° to 43°F (1.5°–6°C) during winter.

The presence of eelgrass and other grass meadows provides several positive attributes for bay scallops. They slow the water flow over the bottom (Fonseca et al., 1982; Eckman et al., 1989; Gambi et al., 1990), and, when bay scallops spawn, their sperm and eggs likely remain mostly within the meadows and thus, as noted, fertilization would have a much better chance to occur than otherwise. After his observations of the sea urchin, *S. droebachiensis*, Pennington (1985) suggested that fertilization rates of eggs in slow currents are likely higher than in swift ones, and, even if the sperm and eggs were long-lived, good egg fertilization would probably be rare in swift currents. This may also be true for bay scallops that spawn in beds devoid of eelgrass meadows.

Future tests involving bay scallops may show that when adults spawn within eelgrass meadows their sperm remains concentrated and has a good chance of being detected in sufficient quantity by other scallops to stimulate them to spawn eggs and more sperm. If the sperm were released on otherwise plain bottoms, it is more likely to be scattered and its concentration so diluted that fewer scallops could detect it and spawn. Moreover, a mass spawning by a given number of adults within the meadows would likely result in a higher



Figure 11.—Town of Nantucket and Nantucket Harbor, Mass.; this harbor is one of the principal bay scalloping areas along the U.S. Atlantic Coast. Photograph courtesy of Nantucket Historical Society.

rate of fertilization than a spawning on plain bottoms because the sperm and eggs would remain together.

The bay scallop larvae, when fully-developed and ready to set, cling to eelgrass blades or other objects with their foot and then form byssal threads that set them onto the blades (Eckman, 1987). The larvae do not crawl over the substrate before attaching to it as do the eastern oyster larvae (Galtsoff, 1964). The timing of attachment coincides with the annual peak in eelgrass biomass, at least on Long Island, N.Y. As the scallops grow and become heavier, they add more byssal threads (Adamson, 1982).

The early life of the bay scallop consists of a series of attachments and dislodgements, with brief swimming periods. The scallop can cast off the byssus at will, move, and soon produce another. The threads are broken off at the byssal gland and left adhering to the object of attachment. Eelgrass provides only an ephemeral substrate for scallop attachment because it sheds its senescent blades as new ones are formed; the blade

turnover is 6–18 days during the time when the scallop larvae set. The scallop retains the power of byssal fixation throughout life, but seldom makes use of it after the first year (Eckman, 1987). This attachment stage is followed by a permanent relocation to the bottom where scallops live unattached, usually but not exclusively, within eelgrass beds (Thayer and Stuart, 1974).

Attachment onto eelgrass blades provides bay scallop juveniles with an above-the-bottom partial refuge from bottom predators. In an experiment on eastern Long Island, N.Y., juveniles tethered to eelgrass above the bottom experienced about a 60% mortality from crab predators, especially green crabs, *Carcinus maenas*, and longnose spider crabs, *Libinia dubia*, against 90% mortality of scallops located near the sediment surface. The refuge effect was less with the say mud crab, *Dyspanopeus sayi*, since it climbed eelgrass blades to prey on the scallops (Pohle et al., 1991). The attachment of juveniles on codium probably provides a somewhat similar above-bottom refuge.

According to Garcia-Esquivel and Bricelj (1993), juvenile bay scallops remain attached to eelgrass blades until they reach a length of about 0.4 in (11 mm), when some locate to the bottom. Others remain attached, but over a 5-week period, nearly all the scallops go to the bottom, and, at a mean length of 1.2 in (31 mm), all are on the bottom. The small scallop recruits to the bottom have the capacity to swim in quick bursts so they can avoid predators. The scallops that have grown to at least 1.6 in (40 mm) have a partial size refuge from predators (Tuttlebach, 1986), and, in eelgrass meadows, the densely-spaced blades provide them with partial cover from their predators (Prescott, 1990).

On shallow flats, eelgrass protects scallops from being washed ashore by strong onshore storm waves. Andrews (1990) reported that scallops were abundant where eelgrass grew in shallow areas in Nantucket Harbor during the 1920's, but when the eelgrass died in 1931 and was absent for nearly two decades, scallops were absent from the flats because they were washed ashore



Figure 12.—A smooth conch or whelk, *Busycotypus canaliculatus*, consuming a bay scallop, Edgartown Harbor, Martha's Vineyard, Mass., 2006.



Figure 13.—Gulls commonly obtain bay scallops in the shallows along the beaches of bays during low tides. Here, a gull is snatching a northern quahog from a fisherman's basket in Nantucket, Mass., about 1947. Photograph by Ginger Andrews.

after setting on small objects. Since the 1950's, when the eelgrass returned, the scallops are present again in some shallows.

Scallops are often most abundant and grow the largest just inside the inlets of bays. At times, they are also found outside the bays in less protected sound waters where the depths are deeper, 12–20 ft (4–6 m). Eelgrass does not grow in the deepest bay scallop environments unless the waters are exceptionally clear.

The identified bay scallop predators in the northeastern waters are oyster drills, *Urosalpinx cinerea*; knobbed whelks, *Busycan carica* (Fig. 12); say mud crabs; longnose spider crabs; green crabs, *C. maenas*; starfish (Rivara³); northern puffers, *Spherooides maculatus* (Rivara³); tautog, *Tautoga onitis*; eider ducks, *Somateria mollissima* (Whittaker⁴); and scup, *Stenotomus chrysops* (Whittaker⁴) and, along shallow shores, gulls (Family Laridae) (Fig. 13) (Belding, 1910; Pohle et al., 1991). Among these, spider crabs probably are not important predators of bay scallops.

In North Carolina, the predators include say mud crabs; knobbed whelks; blue crabs, *Callinectes sapidus*; and cownose rays, *Rhinoptera bonasus*. Where the scallops grow on shallow flats, ring-billed gulls, *Larus delawarensis*; and herring gulls, *L. argentatus*, prey on them during low tides (Prescott, 1990; Bishop et al., 2005).

In recent years, large changes in the distributions of two major bay scallop predators have been observed. The starfish, once listed as the most serious predator of scallops, especially in Buzzards Bay and found in many scallop habitats (Belding, 1910), has nearly disappeared from the bay scallop habitats in Massachusetts, Rhode Island, and Long Island, N.Y. On the other hand, cownose rays have become more abundant and have caused great destruction to the bay scallops in North Carolina (Peterson et al., 2001; Myers et al., 2007).

On the beds from Massachusetts to New York, fishermen had to desist from harvesting sometimes for a few weeks if ice covered the bays during mid winter. When the fishermen returned to harvesting, they found some of the scallops, adults and seed, dead. The scallop meats were intact, but the scallop openers noticed that the muscles did not move as they always did when they removed the upper shell of the adults. The dead

muscles could not be included with the others, or all the muscles in the container would spoil. The cause of the mortality is unknown.

Bay scallop shells, being thin, do not accumulate as oyster shells do on beds. Most adult scallops are caught by fishermen, but the shells of those that die on the beds do not persist. They gradually become thinner and finally disappear after 2–3 years (Conant¹). The only bay scallop shells that are more than a few years old are found intact in buried sediments (Hopp⁵).

Indian Middens

Pre-Columbian Native Americans collected bay scallops for food on a small scale. The shells that anthropologists collected from middens left by the Native Americans on Martha's Vineyard, Mass., probably are similar to those in other areas in southern New England. They were dated between 2270 B.C. and A.D. 1565 (Table 1) by carbon measurements (Ritchie, 1969). The Martha's Vineyard natives had a nearly permanent residence near coasts where shellfish were abundant. A semi-sedentary way of life in small family or extended family groups is suggested (Ritchie, 1969).

⁵Hopp, D. Shellfisherman, Norwalk, Conn., Personal commun., 2006.

³Rivara, G. Biologist, Cornell Cooperative Extension, Southold, Long Island, N.Y., Personal commun., 2006.

⁴Whittaker, D. Biologist, Massachusetts Division of Marine Fisheries, Pocasset, Mass., Personal commun., 2006.

Table 1.—Percentage by weight of identified shell samples in Indian middens on Martha's Vineyard (Ritchie, 1969).

Period	Quahog	Oyster	Softshell clam	Bay scallop	Slippersnail
Late Archaic (2070–2270 BC)	82	11	5	2	1
Transitional	60	18	6	12	2
Early Woodland (430–590 BC)	20	34	14	32	1
Middle Woodland (100–400 AD)	32	16	16	35	3
Late Woodland (1150–1570 AD)	38	8	12	43	5

The findings on Martha's Vineyard show that mollusk harvesting was common. The shells of species most easily taken were the most abundant in the middens, and included northern quahogs; softshell clams, *Mya arenaria*; bay scallops; blue mussels, *Mytilus edulis*; ribbed mussels, *Geukensia demissa*; oysters; and to a lesser extent slippersnails; conchs (whelks), *Busycan carica* and *Busycotypus canaliculatus*; and moon-snails (Naticidae). The most common shells often occurred in discrete masses of single species amounting to a bushel or more (Ritchie, 1969).

Bay scallops were scarce in the oldest (deepest) strata of the middens. This was explained by the scallops' being difficult to catch as they are mobile and inhabit deeper waters. Their valves were more common in the uppermost (youngest) stratum of the middens. Some pottery fragments were found that had impressions of scallop shells on them. Based upon the bones found, the diet of the Native Americans included other animals, mainly the white-tailed deer, *Odocoileus virginianus*; and also seals, *Phoca vitulina*; red foxes, *Vulpes vulpes*; raccoons, *Procyon lotor*; dogs, *Canis lupus*; squirrels, *Sciurus carolinensis*; ducks, Anatidae; and brant, *Branta bernicla* (Ritchie, 1969).

History of Harvesting Gear and Methods

In the 1870's, the first years of the commercial bay scallop fishery, the boats used for harvesting were rowboats, dories, catboats, and sloops; all but the rowboats were under sail. These types of boats were already present in various harbors when the bay scallop fishery began. The principle developments over time that increased the efficiency of bay scallop harvesting were the introduction of: 1) dredges

in the late 1800's, 2) inboard gasoline engines that replaced sails in vessels in the early 1900's, 3) outboard motors in the late 1930's and 1940's, 4) 18 to 20 ft (about 5.5 m) fiberglass boats in the 1960's and 1970's, and 5) motor-powered hoists on boats to retrieve the dredges in the 1960's.

Scallop fishermen have worn boots, cotton or water-proof gloves, caps, pants, and jackets (initially the pants and jackets were made of oilskin—muslin cloth saturated with linseed oil—but eventually rubber was mostly used). In the early 1900's, some fishermen wrapped newspaper around their legs and feet for warmth inside their boots.

Rowboat or Skiff

Flat-bottomed wooden rowboats, 9–14 ft (2.7–4.25 m) long, were used for dredging scallops. In the early years, rowboats were propelled by oars, and since the 1940's by outboard motors when dredging. Rowboats were also used for anchor-roading and picking up ("picking") scallops (both are described in later sections), and also as tender boats used by the fishermen to get from docks to their catboats and sloops that were tied to stakes or buoys. Local carpenter shops made rowboats for scallopers.

Dory

The dory was common in Massachusetts harbors as early as the 1850's (Andrews, 1990). It was ordinarily used on offshore fishing grounds, such as Georges Bank, for hauling trotlines set mainly for cod and haddock and for hauling harpooned swordfish, *Xiphias gladius*. The sides of a dory are high and flaring, its V-shaped transom deep, its bottom flat, and its overall length is 15–17 ft (4.6–4.9 m) and 12 ft (3.7 m) along the bottom. Dories were fitted with a single mast and a mutton (3-cor-



Figure 14.—Dredging bay scallops in a sailing catboat, Nantucket Harbor, Mass., early 1900's. Photograph courtesy of Nantucket Historical Society.

nered) sail to dredge for bay scallops. They were not ideal for dredging as they were unstable.

Catboat

Catboats, widely used to dredge for scallops in the northeast until the 1960's, had a keel length of 18–23 ft (5.5–7 m) and a broad beam (the length to width ratio was 3.5 to 1) that provided a wide spread for towing several dredges and a large deck for handling dredges, culling, and storing bay scallops. Catboats had a shallow draft and were initially sail powered (Fig. 14, 15a, b).

Fishermen tied a heavy rope onto the mast and circled it around the boat's narrow deck (Andrews, 1990; Hiller, no date). The lines to the dredges were fastened to this rope. The dredges could also be fastened to cleats along the rails of the boats. Fishermen commonly tied their dredges only on the stern and one side of the boats, because they sailed somewhat quartering rather than straight ahead. Manila rope, about three-quarters inch (20 mm) in diameter, was used to tow the dredges until World War II. Afterward, it was replaced by polypropylene line, which is thinner, stronger,

lasts much longer, and is not easily lost since it floats (Fig. 16) (Hall, 1984).

Maneuvering the sailboats out of and into wharves crowded with other boats could be difficult. Once underway, the fishermen could reef their sails to maintain the catboats at proper dredging speeds (Fig. 17) (Anonymous, 1895a). Raising or lowering the centerboard also helped to control its movements, and, in the shallowest waters, it could be used as a brake by letting it scrape the bottom. When boat owners and their mates needed to caulk and paint their boats, they hauled them up the slopes of beaches over planks and rollers (Fig. 18). The sails of catboats had to be raised and dried every time heavy rainstorms wetted them to prevent rotting (Fig. 19) (Andrews, 1990).

In the early 1900's, fishermen installed auxiliary "make-and-break" gasoline engines of 5–10 hp in their sailing catboats. The engines had a long bolt for a spark plug at the head of the engine and a six-pack of dry cells furnished the spark. Gas fed into the carburetor by gravity. The engines were difficult to start, they were not sufficiently powerful to do more than assist the sail, they had a narrow range of speed, and they did not have a reverse. To go in reverse, the skipper cranked the engine the opposite way and the engine ran backwards.

Upon installing larger engines, the fishermen removed the mast and sail and replaced the mast with a stub mast, 2 ft (60 cm) high, above the forward deck. The fishermen tied a rope onto the stub mast and circled it around its narrow deck as they had done when sail was used.

Adjusting the pull of the motor to the drag of the dredges was difficult. If towed too fast, the dredges did not touch the bottom; if too slowly, the dredges collected too much sand and could bring the catboat to a stop. The engine helped to maneuver the boats at the docks and moorings. In landing at a dock, the skipper stopped the engine a short distance away hoping he would reach it but not hit too hard. He used a long oar off the stern either as a brake or to scull as needed. The mast and sails

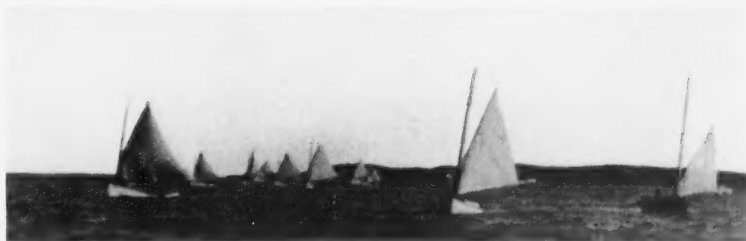


Figure 15a.—A fleet of catboats harvesting bay scallops in Nantucket Harbor, Mass., early 1900's (from Belding, 1910).



Figure 15b.—Catboats harvesting bay scallops in Nantucket, Mass. (from Belding, 1910).

were reinstalled following the scalloping seasons for summer sailing.

In the mid 1930's, the auxiliary engines were replaced with more powerful second-hand, four-cycle automobile engines which had to be converted for marine use. The installation of engines in scalloping boats could be considered as a "revolution" in the fishery, because they greatly enhanced the operations of the catboats. The fishermen then referred to their catboats as "power boats."

Cabin Sloop

Cabin sloops along with catboats were used for harvesting bay scallops in New York and Rhode Island waters in the late

1800's and early 1900's (Fig. 20, 21, 22). They had a 35–40 ft (10.7–12.2 m) keel with a 4–5 ft (1.2–1.5 m) overhang. Their hulls often were lined with bricks or oyster shells for ballast. Afterward, sloops were phased out of scalloping, but catboats continued to dredge under sail into the 1920's.

Water that had leaked into the hold of catboats and sloops was removed with a hand pump made from a round galvanized iron pipe. The pump had a diameter of 4 in (10 cm), stood about 4 ft (1.2 m) high, and had a leather valve at its bottom and a 6 in (15 cm) spout near its top; a wooden plunge stick was inside. The fisherman put the end of the

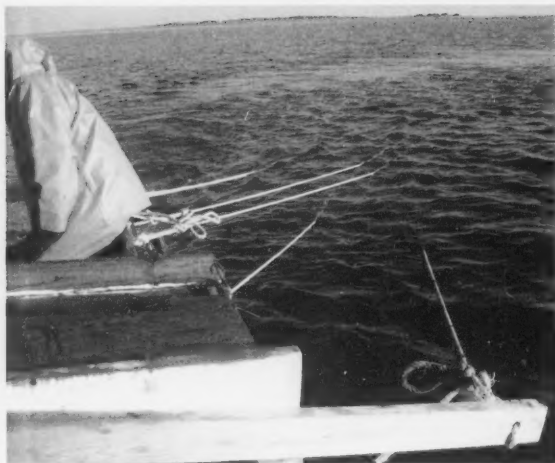


Figure 16.—Towing bay scallop dredges from a motorboat using polypropylene ropes, Cape Poge Pond, Edgartown, Mass. in 2006. Note end of culling board at lower left.



Figure 17.—Dredging for bay scallops in a stiff breeze. Eelgrass has collected on the culling board and side of the catboat, Nantucket, Mass., early 1900's. Photograph courtesy of Nantucket Historical Society.

pump into the deepest part of the hull, poured water into its top to prime it, and then rapidly raised the plunger up and down; water was sucked up the tube and it spilled out the spout onto the deck and out its scuppers.

Sharpie

The sharpie was used to some extent to dredge for bay scallops (Ingersoll,

1887). Relatively long and narrow with a flat bottom and a shallow draft, it had 1 or 2 masts that supported triangular sails.

Skiff and Outboard Motor

Skiffs (wooden rowboats), 12–15 ft (3.7–4.6 m) long, began to replace catboats in the bay scalloping fleets when outboard motors became available in the

late 1930's. The scallopers considered outboard motors to be a great boon. Their use constituted another "revolution" in the scallop fishery, and with their availability many more men, especially the part-timers, had the opportunity to earn extra money by scalloping. Narrower than catboats, the skiffs had a more cramped working space. Fiberglass skiffs later supplanted the wooden rowboats. The landings of scallops in each bay increased when outboard motors became available, because the fishermen could harvest scallops in more locations than when catboats were the main dredging boats, especially when they were under sail, and they could also get in more harvesting days before an ice cover formed and prevented further scalloping until it melted.

In the late 1930's, the first outboard motors available had just 5 hp and cost about \$100 each. With such little power, a skiff had to dredge across a bay scallop bed with, but not against, the direction of a swift current. The motors did not have a reverse gear, so to go in reverse the fishermen rotated it 180° (Palmer⁶). Over the years, the fishermen purchased larger outboard motors as they became



Figure 18.—Leaks between the planks of catboats were caulked on beaches at low tide, Nantucket, Mass., about 1920. Photograph courtesy of Nantucket Historical Society.

⁶Palmer, A. Shellfish officer (ret.), town of Westport, Mass., Personal commun., 2006.

available. An 18-hp outboard could tow as many as 8 dredges (Reynolds⁷). When the landed prices of scallops rose in recent years, the fishermen purchased larger 25–40 hp engines for \$3,000–\$4,000 (Fig. 23).

Bay scallopers in motorized catboats referred to the group of outboard motor boats as comprising the “mosquito fleet” (Fig. 24). But despite the difference in the sizes of the boats, the crews in each type of boat caught the same quantities of scallops, i.e. no more than the local town or state limit, and each made about the same amount of money in a season.

Power Lift on Skiffs

In the 1960’s, Massachusetts fishermen began rigging power lifts on their 16–20 ft (5–6 m) outboard-motor skiffs, to aid in hauling, lifting, and emptying their dredges, thus saving the heavy labor in doing this. The introduction of the power lifts constituted a third “revolution” in the bay scallop fishery. The lifts consisted of a metal A-frame or else a square frame mounted in the center of the boat 4–6 ft (1.2–1.8 m) above the deck with 1–2 pulleys at the frame’s peak. Directly below the pulley of an A-frame, a 3–5 hp gasoline engine with a hauling disc was fastened to the boat’s floor (Fig. 25). The fishermen pulled in some line to a dredge, swung a loop of it over the pulley, and then wound the line around the hauling disc to retrieve the dredge. When this lift became available, some fishermen used heavier dredges, up to 55 pounds empty, this weight being the maximum legal limit for dredges used for scalloping in some towns.

North Carolina Dredging Boats

The North Carolina dredging boats included flat-bottomed wooden skiffs with one-cylinder engines, skiffs with outboard motors, and wooden boats 23–25 ft (7–7.6 m) long, with automobile engines. The boats towed 4 A-framed dredges (termed “drags” locally); the dredges had nylon net bags top and



Figure 19.—The sails of catboats had to be raised for drying if they became wet, to prevent rotting, Nantucket, Mass., about 1920. Photograph courtesy of Nantucket Historical Society.



Figure 20.—Sloops harvesting bay scallops in Peconic Bay, N.Y., about 1910. Scene on postcard.

bottom and they never were used with pressure plates. The dredges gathered scallops on bottoms consisting of a surface of mud and grass. Such bottom surfaces would not wear out or tear the net, so a metal ring bag on their bottom was not needed. In place of pressure plates, the fishermen often tied window weights onto the dredges. The weights were removed where the sediment bottoms were especially muddy or shelly (Smith²).

To have their dredges spread in a wide path over the bottom, the fishermen attached a sturdy pole 2 × 4 in (5 × 10 cm) across their boats near the bow on which to tie the dredge ropes. The pole extended as far as 3 ft (0.9 m) beyond each side (Fig. 26, 27). On some boats, the pole was placed near the bow, and the dredges were towed with short ropes of equal length, so the dredges were on a line with the stern of the boat while being towed; the distance between the

⁷Reynolds, J. Shellfisherman, Bourne, Mass., Personal commun., 2006.

dredges was about 2–6 in (5–15 cm). The fisherman attached thin lines to each dredge rope so they could pull them over to the boat when retrieving the dredge. The dredges were emptied onto a culling board (locally termed “cull tray”) lying across the stern of the boat. Other fishermen placed the pole farther aft, and the dredges were then towed about 6 ft (2 m) back of the stern (Gutsell, 1929). Some of the scalloping boats were used for blue crabbing and finfishing in other seasons (Smith²; Willis⁸).

⁸Willis, B. Shellfisherman, Atlantic Beach, N.C., Personal commun., 2004.

By the 1960's and 1970's, most North Carolina dredging boats were constructed with recessed tunnels in their bottoms near their sterns to house their propellers driven by inboard motors. The tips of the propeller blades extended only 4 in (10 cm) below the bottom of the boat. This design allowed them to tow dredges in areas containing scallops where waters were 2–4 ft (60–120 cm) deep. Outboard motors could not be used in such depths. The boats continued to be fitted with spreader poles. Some towed 6 rather than 4 dredges when the bay scallops became scarcer. Dredges were towed slowly. The fishermen picked the scal-

lops off the cull tray into half-bushel or one-bushel baskets and emptied them into large sacks; second-hand coffee bags were commonly used (Smith²).

Dredging or Dragging

Dredging has been the principal method for harvesting bay scallops throughout the history of the commercial fishery. The scallop dredge or “drag” is 28–36 in (70–90 cm) wide and has a long V-shaped iron bridle for effective towing and ease in bringing it aboard boats. In most states, its bag has a heavy linked chain (Fig. 28) or a thin bar on its leading edge at the bottom (Fig. 29), metal rings comprise its bottom in most locations, and cloth netting, 3–4 in (7.5–10 cm), comprises its top. It holds about a bushel of material (Anonymous, 1885a). A wooden stick, about 1.5 in (4 cm) square, can be attached across its back so the fisherman can get a good grip on the bag to lift for emptying. In the 1980's, the fishermen in some Massachusetts bays began using “pan dredges,” so called because they have a pressure plate (“diver”) attached (Fig. 30). They scrape harder against the bottom and collect more scallops (Fig. 31) (Sherman⁹; Pierce¹⁰).

Belding (1910) described how only portions of bay scallop grounds are productive in any one year and how the locations of productive grounds vary among years. The fishermen knew the locations where the scallops were likely to be abundant at the beginnings of seasons, because they had observed where seed was abundant when they harvested during the previous year and when they had been quahogging just a few weeks or days earlier (Poole, 1965).

When scallops were concentrated along the edges of shoals or in narrow channels, the catboat fishermen using sail had to wait until the wind was in the proper direction to harvest scallops. All the boats had to go in the same direction, and in channels they were arranged in a line with the wind. As many as 50



Figure 21.—Another view of sloops harvesting bay scallops in Peconic Bay, N.Y., in light breeze, about 1910. Scene on postcard.



Figure 22.—Sloops (left), used for harvesting bay scallops, tied along The Creek, New Suffolk, Long Island, N.Y., about 1910. Scene on postcard.

⁹Sherman, G. Shellfish officer, Westport, Mass., Personal commun., 2006.

¹⁰Pierce, B. Shellfisherman (retired), Westport, Mass., Personal commun., 2006.



Figure 23.—(above) Bay scallop boat without a hoist for lifting its dredges, Edgartown, Martha's Vineyard, Mass., 2006.



Figure 24.—(above right) Some regular and part-time fishermen harvesting bay scallops commercially in Peconic Bay, Long Island, N.Y., late 1970's. Photograph courtesy of Debra Barnes, New York State DEC.



Figure 25.—(right) The hauling disc on the scalloping boat is visible just below the culling board, Edgartown, Mass.



Figure 26.—The North Carolina scalloping boats have a pole across them to spread out the dredges they are towed. Photograph courtesy of North Carolina DMF.



Figure 27.—This North Carolina boat tows eight dredges to harvest bay scallops; the poles extending from the hull spread out the dredges. Photograph courtesy of North Carolina DMF.



Figure 28.—A bay scallop dredge with linked chain on its leading edge at the bottom, Edgartown, Mass., about 1950.

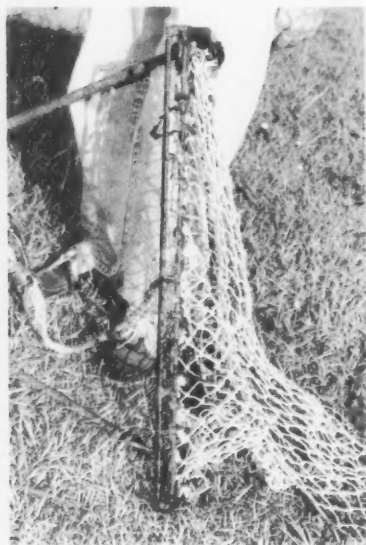


Figure 29.—A bay scallop dredge with bar on its leading edge at the bottom. Two parallel bars are used; the lower one scrapes along the bottom; the netting is attached to the upper one so it will not be worn by scraping against the bottom sediments.

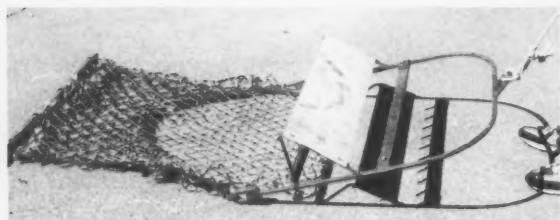


Figure 30.—A bay scallop dredge with pressure plate is termed a pan dredge, Westport, Mass., 2006.

sailboats at a time worked on a large bed (Andrews, 1990).

Wind speed determined the number of dredges a sail boat towed: 1 or 2 in a light wind, and as many as 12 in a strong wind. In a strong wind, the crew took in two reefs in the sail. At the end of a drift, the fishermen had the sterns of their catboats facing the wind or oncoming water current while retrieving the dredges so the boats would not drift back over the dredges as they were hauled. After finishing a drift, the boats tacked back to the windward side of the bed to begin dredging again.

By constantly pulling their dredges to determine their contents, fishermen knew just where a bay scallop bed began and ended. In a catboat that had two fishermen towing 6 dredges, each drift had to collect at least a half bushel of scallops for them to obtain their daily limit, and still have the time to open all the scallops by late afternoon. If below a half bushel, the fishermen shifted to another bed. The dredging boats usually made about 10–12 drifts (runs) across beds/day to harvest their daily limit.

When fishermen with motor boats begin dredging for bay scallops in dense

meadows of eelgrass, they do not get the scallops easily until several days later because by then the dredging had “worn” some of the eelgrass off the beds (Fig. 32). The rhizomes and roots of the eelgrass plants remain undisturbed beneath the sediment surfaces. When a boat tows 6 dredges, 3 on each side, the first dredge comes in nearly full of eelgrass and few scallops, the next dredge catches less eelgrass and more scallops, and the third dredge has the most scallops. The first dredge catches most of the loose eelgrass in the path while it also stirs up the scallops behind so they are taken more readily by the dredges that follow. A strong northeast storm, usually in December, blows most loose eelgrass ashore or into hollows and the best harvesting comes after this. The eelgrass grows back the following year (Fig. 33).

Many fishermen dredged for scallops in three locations, for at least an hour in each during a day. They could obtain their limit in one of the locations, but by going to the other locations they were disguising from the other fishermen the location where they obtained most of the scallops and also determining the quantities of scallops on other beds for the harvesting days ahead.

The dredges were hauled aboard and emptied of scallops and shack onto the



Figure 31.—A bay scallop pan dredge in use, Cape Poge Pond, Martha's Vineyard, Mass., 2006.

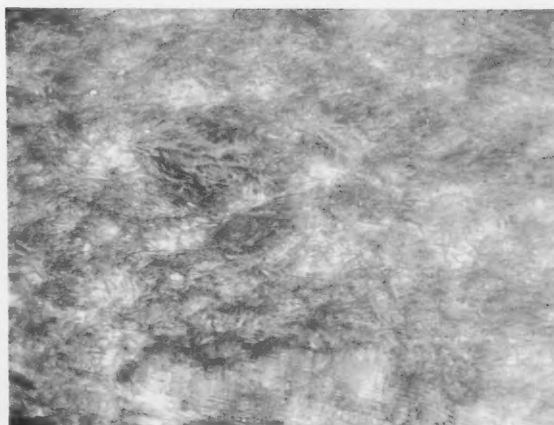


Figure 33.—This eelgrass meadow grows in June after being dredged over heavily for bay scallops during the previous fall–winter season, Cape Poge Pond, Martha's Vineyard, Mass., 2007.

Figure 32.—Fishermen commonly dredge up large quantities of loose eelgrass when they harvest bay scallops, Nantucket Harbor, 1950's. Photograph courtesy of Nantucket Historical Society.

culling board. The scallops were picked off and tossed into pails or baskets and the shack and seed were pushed overboard, while the boat was towing the dredges on another drift. Ten or more gulls often followed the boats, looking for an opportunity to swoop down and catch some of the crabs among the shack before they sank below the reach of their beaks. If a gull caught a crab (commonly a spider crab) in its beak, it flew to a shore, rose higher, and dropped it onto a jetty stone or roadway to crack open its carapace, leaving its soft tissues available to pick out as food. Whenever scallops were exceptionally abundant and clean (no shack or seed with them), the Nantucket fishermen used dust pans to remove them from the culling boards and empty them into containers (Reinemo¹¹; Sayles¹²).

The best fishermen landed the most scallops in a season. Besides being stronger and more persistent, they knew

the bottoms of their local bays as well as they did their own back yards. Each day, the most competitive fishermen tried to be the first in a fleet to head for the docks with their limits. Such fleets could be comprised of catboats and outboard-motor boats (Fig. 34).

The containers for scallops on the boats changed over the years. In the first years, fishermen held them in woven coal baskets, then in the early 1900's to 1950's state-issued burlap bags, in Massachusetts at least (Fig. 35), and nowadays plastic boxes and baskets are used. The Massachusetts bags held 2 bushels of scallops and the name of the town was stamped on them in large black letters. The boxes hold about a bushel.

In the 1950's, a method of harvesting bay scallops in Menemsha Pond, Martha's Vineyard, involved a large motor boat towing a line of motorless rowboats, each with a fisherman and towing two dredges. The fishermen retrieved and emptied their dredges every several minutes. The boats were towed in a circle so some of the dredges from each boat would be on new grounds (Gaines¹³; Flanders¹⁴). The fishermen in

each rowboat paid the crew of the motor boat for towing them.

Use of Small Gear

Pusher

The pusher was one of the earliest gears used to harvest bay scallops. It consists of a rectangular iron frame, measuring 3 × 1.6 ft (0.9 × 0.5 m), with a net bag, attached to a wooden pole 8–9 ft (2.4–2.7 m) long (Fig. 36). The scalloper waded across the shallows at low tide and shoved his pusher ahead through the eelgrass. When the bag was partly filled with scallops, he picked out the scallops and put them into his rowboat or dory (Belding, 1910).

Rake

Fishermen have used modified quahog rakes, 2–2.6 ft (60–80 cm) wide, for harvesting bay scallops. They welded a bar across the front of the teeth, to prevent the rake from digging into the bottom.

¹¹Reinemo, K. Shellfisherman, Nantucket, Mass., Personal commun., 2006.

¹²Sayles, C. Shellfish and fish dealer, Nantucket, Mass., Personal commun., 2005.

¹³Gaines, D. Shellfisherman, Edgartown, Mass., Personal commun., 1951.

¹⁴Flanders, D. Shellfisherman, Menemsha, Mass., Personal commun., 2006.



Figure 34.—Fishermen conferring about whether to halt scalloping for several days because the market price has dropped, Edgartown, Mass., about 1950.

While standing in small drifting boats, the fishermen pulled the rakes over the bottom to collect the scallops. This rake was used in eastern Long Island (Bourguignon¹⁵) (Fig. 37, 38, 39) and in the early 1900's also in Westport, Mass. (Pierce¹⁰).

Anchor Roding

Some bay scallop fishermen in the Peconic Bay area and on Martha's Vineyard and perhaps other areas, harvested scallops using a method termed "anchor roding" (fishermen commonly substituted the word road for rope) at least during the 1940's and likely much earlier. Rowboats were used. The remaining gear consisted of a light-weight iron anchor attached to a rope at least 150 ft (45 m) long, one or two dredges, and a pair of oars. When two dredges were used, they were fastened to the opposite corners of the boat's stern. The anchors used in all types of boats, Massachusetts to North Carolina, had a moveable cross pin so they could be laid flat when not in use. They were constructed by local blacksmiths.

Anchor roding was perhaps the most labor-intensive type of bay scalloping. The fisherman rowed up-wind or up-current to the far side of a scallop bed. He tossed his anchor ahead of the boat and jerked the rope to set it into the bottom, then rowed the boat stern-first into the

bed to the end of the rope. He tossed out his dredge(s) as far as he could, stepped to the bow, and pulled the rope hand-over-hand back to the anchor, and fastened the rope to a cleat. He then went to the stern, pulled in and emptied the dredges onto the boat's back seat, set them aside, and picked out the scallops and tossed over the shack and seed scallops. The anchor rope was then released from the bow, and the boat was again rowed into the bed. The procedure was repeated several times until the harvests became too small. The anchor then was pulled and tossed far to the left or right so new ground would be dredged, and the process was continued. During the 1930's, at least 90 men on Martha's Vineyard harvested bay scallops by the anchor roding procedure. Anchor roding ended when the outboard motor became available to tow the dredges.

Picking-Up, Picking, or Dip-Netting

Small numbers of fishermen in some bays harvested bay scallops that were in water depths of 3–8 ft (0.9–2.4 m) by picking them up one at a time. This method was observed being used in the late 1870's (Ingersoll, 1887), and from the 1930's to the 1980's by 10–15 fishermen each on Martha's Vineyard and in Peconic Bay, Long Island, N.Y. It was termed "picking up," "picking," or "dip netting" (Fig. 40). The gear required



Figure 35.—Unloading bay scallops held in burlap and net bags onto a dock, Nantucket, Mass., early 1900's. Photograph courtesy of Nantucket Historical Society.

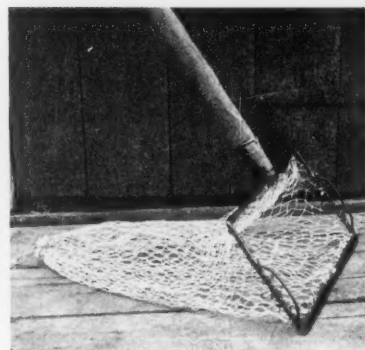


Figure 36.—The pusher consists of a wooden pole, 8–9 ft (2.4–2.7 m) long, attached to a rectangular iron framework 3 x 1.5 ft (0.9 x 0.45 m), fitted with a netting bag 3 ft (0.9 m) in depth. A fisherman, wading in shallow water, gathers scallops from the flats by shoving the pusher through the eelgrass meadows. The photograph shows the correct position of the pusher in operation. A small part of the pole is shown (from Belding, 1910).

was a rowboat, a home-made look-box ("peep-sight"), a scoop net, and a drag anchor (a discarded iron weight without a hook so it could not anchor in the bottom).

A look-box is 1.0–1.5 ft (30–45 cm) high and it tapers toward its upper open side. The opening is square, about 9 in

¹⁵Bourguignon, R. Shellfisherman and dealer, Flanders, Long Island, N.Y., Personal commun., 2006.



Figure 37.—Raking bay scallops in Cold Spring Pond, Southampton, eastern Long Island, N.Y., 1970's. Dredging for bay scallops is not allowed in the New York ponds. Photograph courtesy of Mary Van Deusen.



Figure 39.—Emptying bay scallops from rake onto culling board, Cold Spring Pond, Southampton, eastern Long Island, N.Y. Photograph courtesy of Mary Van Deusen.



Figure 38.—Removing grasses from rake before dumping bay scallops onto culling board, Cold Spring Pond, Southampton, eastern Long Island, N.Y., 1970's. Photograph courtesy of Mary Van Deusen.

(18 cm) on a side. The bottom of the look-box, also square, is 1 ft (30 cm) on a side, with a clear pane of glass sealed into it. After the fisherman wets the glass to remove the glare on its surface, he can see clearly the scallops on the bottom. The scoop net has an 8-inch (20 cm) diameter ring on one end of an 8 to 9 ft (2.4–



Figure 40.—Harvesting bay scallops using a round look-box ('peep-sight') and scoop net on pole, Sengecontacket Pond, Martha's Vineyard, Mass., about 1950. Water depth about 8 ft (2.4 m).

2.7 m) pole, and it holds about 25 scallops (Flanders¹⁴) (MacKenzie, 1992).

When harvesting bay scallops using a look-box, the rowboat drifts slowly over a bed with a drag anchor over one side, which while sliding over the bottom maintains the boat at a proper speed. The scalloper leans over the opposite side with his knees against the side of the boat, holding the look-box by its handle with one hand and his scoop net in the other. His face is against the top of the box as he peers through it at the bottom. He positions the scoop net straight down and the bottom of the ring is 2–3 in (5–8 cm) above the bottom. When he sees a scallop, he hits

its closest side with the bottom of the ring and it rolls into its net. Upon filling the net with about 25 scallops, he brings it up to the boat and empties it. A good rate of catch is about one bu/hr.

Recreational fishermen currently wade along the shallows using a look-box and scoop net and a wire basket attached to the inside of a float ring (usually an old automobile tire tube). Their scallops are tossed into the basket.

In North Carolina, fishermen harvested bay scallops on broad shallows, 6 in to 2 ft (15–60 cm) deep, while wading and using a scoop net similar to the one described above to gather them.

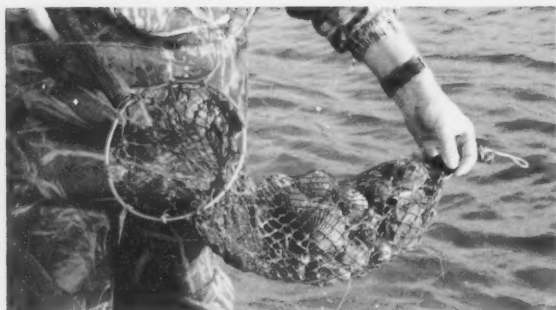


Figure 41.—(above left) Scoop net for harvesting bay scallops at wading depths, North Carolina, 2001.



Figure 42.—(above right) North Carolina bay scallop fisherman beside his harvesting gear: scoop net to harvest the scallops; basket is placed in rubber tube and is towed from the fisherman's waist; and small boat ("bunt") holds the baskets of bay scallops.

Figure 43.—Bay scallop opener emptying barrel of shells and guts, Edgartown, Mass., about 1990.

The sediments in the shallows as in the deeper waters are a firm "sticky" mud, which meant that fishermen had to pull their feet out of the mud to take each step. The scallops could be seen easily during calm winds, but on windy days the choppy surface of the water made it difficult to see the bottom. To harvest scallops, each fisherman anchored 3–4 duck decoys in a row 4–6 ft (1.2–1.8 m) apart and upwind of the harvesting area. He laid a cloth that he had saturated with menhaden, *Brevoortia tyrannus*, oil over each decoy and placed the cloth so some of it touched the water and an oil slick was released over its surface. The fishermen could then see the scallops. He then had to wade through the slick into the tidal current, because his steps lifted into the water a cloud of mud that flowed with the current away from him, and he scooped the scallops. He emptied them into floating baskets; when full, the

baskets were set on small floating crafts ("bunts") (Fig. 41, 42).

Opening Scallops

In a typical day during a bay scallop season, the fishermen landed their daily limit of several bushels of scallops on docks around noon. They had decided where they were going to harvest on the following day during the running time of 10–20 minutes from the harvesting beds. They spent most of the afternoon opening the scallops.¹⁶ If a fisherman

had 5 bushels, he would have a pile of nearly 1,800 scallops to open. This would take him about 3 hours to finish. The fishermen were tired at the end of the work day because they had to stand continuously while running their boat, hauling in and emptying their dredges, and culling the scallops. While they opened scallops, they had to stand in one spot until finished. The only breaks taken were to pile more scallops onto their bench and to roll their barrels of shells outside to empty (Fig. 43). If some people had to open all day, they took turns standing and then leaning against a stool while they opened to ease the physical strains, especially in their backs. When finished, they went home with cash in their pockets that totaled about the same amount as each of the other scallopers, but substantially more than nearly all the other workers in their community.

¹⁶No documentation was available that described how people initiated and developed the process used to open scallops, or when it was discovered that the muscle is tasty and sweet and became a fishery product. The guts (rims) have nearly always been discarded presumably because large sections of them are brown and nearly black, even though they are tasty and undoubtedly nutritious. The design of the bay scallop knife probably was formed by grinding down a kitchen knife to make it efficient for opening scallops; eventually one or more factories made them.

Bay scallops were opened in wooden shanties, fish markets, and in garages, cellars, and kitchens in fishermen's homes. Nearly all were opened on the day in which they were harvested; if not, usually in the morning of the following day. The shanties were commonly arranged in groups of 5 or more on docks or along shores, and when fishermen landed their scallops, they had to carry them perhaps no more than about 75 ft (23 m) to the shanties and fish markets (Fig. 44, 45, 46, 47, 48, 49). The shanties measured from 10 to 20 ft (3–6 m) long by 10 ft (3 m) wide, and they had a bench about 3 ft (0.9–1 m) wide, and about waist high running along their lengths. The scallops were dumped onto the benches for opening and packing (Belding, 1910).

A harvest of bay scallops has some biological characteristics that identify the particular area from which they were harvested, and, when a fisherman set his scallops on docks or brought them into a fish market to be opened, the other fishermen usually glanced at them to determine where they had been harvested. Scallops from one area may have barnacles on their shells, while from other areas they may have attached slipper snails; the common jingle, *Anomia simplex*; white coiled worms, *Spirorbis borealis*; or white sponge-like tunicates (*Didemnum* sp.). Scallops from different areas also may have various types of grasses (eelgrass, moss-like red algae, and codium) mixed with them. Also, the color pattern of the scallop valves can differ among areas (Lane¹⁷).

A knife of unique design has been used for opening bay scallops. Its blade is 2 in (5 cm) long, has a rounded end and is sharp on one side but blunt on the other. Its handle was initially made of wood, but for sanitary reasons it now has to be plastic (Fig. 50). The opener holds the scallop in the palm of his/her hand with its hinge facing his finger tips. The scallop's "eye" being off-center is closer to the scallop's right side when the top or flat side is facing upward. A right-handed person inserts the knife into the

slit between the two valves, gives it an upward turn to cut the "eye" away from the upper valve, then this valve is pushed upward with the knife far enough that it breaks away from the lower valve and it falls into a 25–30 gallon barrel resting on the floor below his hands. The blade then is pushed against the lower valve and circled around and against the "eye." The opener's thumb grasps the guts (mantle and visceral rim) against the knife blade, and he tears them away from the "eye" toward him, and drops them into the barrel with the shells (Fig. 51). The "eye" is scraped off the lower shell and flipped in one motion into a gallon can sitting to his right on the bench.

The opening moves are made quickly: A typical person opens about a gallon (480 "eyes")/hr. A 32 quart bushel of whole scallops (350 scallops) yields about 3 quarts or 6 pounds of scallop "eyes." The noises heard in an opening house are the scraping of the knife blades against the valves, the shells and guts landing in the barrels, and the low voices of the openers remarking to each other about the scalloping season (Poole, 1965). Note: The southern scallop in North Carolina has a larger mass of guts than the northern scallop; the opener places his thumb on the "eye" ("heart") and then lifts off the guts in one pull. If he grasps the guts as he would for a northern scallop, he would tear off only a part of them and then have to make another grasp or two to remove the entire mass.

In the late 1800's and early 1900's, fishermen could harvest bay scallops each day until dark, but most arrived at the landing docks in the late afternoon. Some town men, women, and children came to the shanties to earn money by opening scallops as soon as they were landed. The openers used kerosene lanterns to see in the shanties at night. The scallops were packed in butter tubs, and the next morning, the dealer came, paid cash for them, and sent them to markets (Hiller, no date).

The fishermen's wives, mothers, brothers, and children age 10 years and above were commonly involved in opening the bay scallops. The openers also

included retired men and some others, who were employed in 8-hr day jobs and opened scallops in the evenings and on Saturdays to earn extra money while it was readily available to obtain.

The openers were paid according to the volume they produced. They desired large scallops because they had the largest "eyes" and hence filled containers faster. They pleaded with the fishermen not to go for small scallops that the fishermen might harvest more quickly. Those with small meats usually came from dense eelgrass meadows. In a particular day, if the quantity of scallops available to the openers was limited, competition among them was keen to open as many as possible before the supply was exhausted.

In Massachusetts, whenever bay scallops were scarce in a town and a nearby town had a large supply, some openers, including the unemployed scallop fishermen, earned money by driving each day to the other town to earn money by opening scallops. On Martha's Vineyard, as many as 20 people from other island towns went to Menemsha to open whenever Menemsha Pond had large landings (Fig. 52) (Flanders¹⁴; Poole¹⁸). Dealers sometimes purchased unopened scallops in one town and drove them to another to be opened.

Bay scallops cannot be shipped to markets alive in the shell because they gape and close continuously and their soft tissues become dry. They die in a day or two and begin to decay. Besides, the freighting of whole scallops to markets would be more costly.

The refuse from opening bay scallops consists of the two valves and the guts. Most of the guts have always been discarded with the shells on piles where gulls have eaten them (Fig. 53). From at least the early 1900's through the 1920's, some guts were retained for fish bait and even as garden fertilizer. On Martha's Vineyard, the guts were often salted and sold to commercial finfishermen for about a \$1.00 a bucket, to be used as bait on trotlines (handlines laid on the bottom with spaced fish hooks) to

¹⁷Lane, W. Shellfisherman, Quogue, Long Island, N.Y., Personal commun., 2006.

¹⁸Poole, E. Shellfisherman, Chilmark, Mass., Personal commun., 2001.



Figure 44.—Bay scallop shanties in Chatham, Mass., early 1900's. Scene from postcard.



Figure 45.—Bay scallop shanties in Hyannis, Mass., early 1900's. Scene from postcard.



Figure 46.—Bay scallop shanties in Cotuit, Mass., early 1900's. Scene from postcard.



Figure 47.—Shanties for opening bay scallops set on a wharf in Marion, Mass. The scalloping boats are tied along the wharf, early 1900's. Photograph courtesy of Charles Bradley.



Figure 48.—(above) Summer scene in Edgartown, Martha's Vineyard, Mass. The row building on water's edge at right center consists of several scallop shanties; large two-story building at left center is a fish market where scallops are opened and sold during scalloping seasons; the catboats in right foreground and the one in the front of the row building are used to harvest scallops during the fall-winter season, 1950's.

Figure 49.—(right) Bay scalloping scene in Menemsha, Martha's Vineyard, Mass. A fisherman is carrying his scallops into a shanty. At lower right, opener empties shells onto a pile. Boat in channel is harvesting scallops. Lobster pots are stored at lower left. Painting by Stanley Murphy with the title, "Menemsha Winter."





Figure 50.—The bay scallop knife has a 2-inch (5-cm) blade. The knives used for many years had wooden handles (lower), but, later, state health departments decreed that the handles had to be plastic (upper) for public health reasons.

catch Atlantic cod, *Gadus morrhua*, and haddock, *Melanogrammus aeglefinus*, and also to bait eel pots. The salted guts were also sold to anglers to use as bait for scup, *Stenotomus chrysops*; black sea bass, *Centropristis striata*; and summer flounder, *Paralichthys dentatus*, during summers (Fig. 54) (MacKenzie, 1992). The shells later were trucked to town dumps, or spread on driveways (Fig. 55), or on farmers' fields to "sweeten" acidic soils (Sayles¹²), or were used as cultch to collect seed oysters (Sayles¹²) (Belding, 1910).

Overview of the Fishery Regulations

The bay scallop fisheries have been regulated by public agencies almost since their beginnings (Fig. 56). The legal season once began at the beginning of September, the same as the oyster season. However, the states and coastal towns have pushed the dates farther back, usually to October 1st and in some locations to November 1st (Anonymous, 1894). Scallops grow somewhat during October and a slightly larger volume of scallops and meat yield will be available if they are left until November for harvesting (Belding, 1910). Besides, many fishermen were committed to other jobs and did not want to leave them in September and October. The legal season lasts until the end of March.

Bay scallops are unique among four of the principal commercial bivalves



Figure 51.—Three steps are involved in opening a bay scallop.

landed in bays and estuaries along the Atlantic Coast of North America, in that two year classes, rather than several as with oysters, quahogs, and softshell clams, make up their populations. This makes it easier for management agencies to regulate the scallop fishery. State authorities allow the fishermen to harvest the entire older year class, but they must leave all the younger year class, the juveniles, in the beds. Scallops cannot be overharvested as long as this rule is followed. In the fishery, juveniles are termed "seed" or "spat" as is the case with other bivalves, but they are also called "bugs" in New York and "spawns" in North Carolina. The legal rules also relate to gear restrictions and sanitary rules regarding the processing and packing of scallops.

The Limit

The quantity of scallops that a fisherman is legally allowed to take each day is referred to as the "limit." The daily scallop catches are limited in each state, and in Massachusetts, at least, the towns have ruled that limits would be smaller than the state limit (Fig. 57). When abundant, bay scallops can be harvested quickly with dredges—up to 2–3 bushels/drift with 6 dredges—and the grounds could be depleted of scallops too fast in the absence of the daily harvest limit. The purpose for establishing limits was to spread earnings over an extended time and to prevent nearly all available scallops from being sent to market during the first weeks of seasons, a circumstance that would have flooded the market, resulted in low prices, and brought less money into the towns' economies.

The challenge scallopers faced each morning as they headed for the beds was to obtain their limits (Fig. 58). The

term, limit, was mentioned regularly by the scallopers:

"Today, I got my limit by 9:30."

"I couldn't get my limit today because I couldn't find them."

"He took his wife with him last week and got two limits every day."

Importance to Local Communities

The residents of scalloping communities have been proud of their good-tasting, highly-priced bay scallops and their attractive shells that are observed in many types of decorations (Fig. 59). When such local names as "Cape scallops" (Cape Cod), "Nantucket scallops," and "Peconic scallops" (Peconic Bay, Long Island) have been used, they suggest a superior food. The cost for communities to have scallops on their beds is extremely low, so the money derived from the scallop harvests, especially during the years when the scallops were abundant, boosted the local economies considerably during winters. Moreover, community residents looked forward to eating meals of bay scallops every new season, and many relished the mornings just before dawn when (from the 1920's to the 1950's) they awakened in their beds and heard the loud, uneven sound of the "put-put" engines in the scalloping boats as they were leaving the harbors for the scallop beds (Mello Silva Jeffers¹⁹).

The scallop is a high value product that provides a high return per unit of fisherman effort, and fishermen liked being paid in cash for their scallop

¹⁹Mello Silva Jeffers, G. Housewife, Edgartown, Mass., Personal commun., 2005.



Figure 52.—Packing baskets of Menemsha Pond bay scallops in Chilmark, Martha's Vineyard, Mass., 1950's. Photograph courtesy of Spinner Publications, New Bedford, Mass.



Figure 54.—Containers of bay scallop guts and meats (adductor muscles) ready for sale to a tackle shop (guts) and fish market (meats). Flanders, Long Island, N.Y., 2006.



Figure 53.—Bay scallop, *Argopecten irradians irradians*, shells in a pile after gulls have eaten the guts (rims). Martha's Vineyard, Mass.



Figure 55.—When crushed, northern bay scallop shells make an attractive driveway.

meats, usually between 3 and 6 p.m. every afternoon. Individual fishermen, especially those who brought along their wives on their boats so two limits could be landed each day, could earn enough money to purchase ample clothes and shoes for their families, pay their taxes, have plenty for Christmas, and have some left to put in the bank. Their wives considered going with their husbands as well worthwhile financially, and their work of culling the scallops was not difficult. When the seasons began at the first of October, the money earned by

scalloping was made by Thanksgiving (Warncke²⁰) (MacFarlane, 2002). The fishermen liked the money, freedom, independence, and the peace and quiet of a scalloping season, besides working among a fleet of boats and other fishermen they knew. Bay scalloping was their way of life in the fall and winter (Waring, 1988).

The suppliers of fishermen's gear, i.e. outboard motors, dredges and anchors,

rope, work clothing, and gasoline, and also the local food markets noticed that their sales increased during the good scalloping years. On the other hand, seasons of low scallop abundances resulted in slower local economies.

Scallop fishermen have been adaptable. They have tried to keep two or three job opportunities available. They have preferred to go scalloping, because they have their boat and gear available, they have the skills and knowledge to make good harvests and to open the scallops, and scalloping would bring them

²⁰Warncke, D. Shellfish officer, Bourne, Mass., Personal commun., 2005.

the most money. But when scallops have been scarce, they have worked, at least part-time, at the other types of jobs.

Most bay scalloping communities have been summer resorts. During the fall and winter, the local bays may be occupied by scallop fishermen, whereas during the summer they are occupied by summer people, who are sailing and fin-fishing, and some quahoggers. Summer tourists usually do not come in contact with the scallop fishery, except for noticing a few idle scalloping boats tied to docks with dredges left in them, but they may find bay scallops on the menus of seaside restaurants. The restaurants had kept them frozen since the previous fall and winter.

A Free-For-All Fishery

Bay scalloping always has been a "free-for-all" fishery, meaning that all local residents have had a legal right to purchase a commercial license and then harvest the scallops within limits of the law. A scalloping fleet had two categories of people. The men who made most of their living as fishermen comprised one category. In Massachusetts, Rhode Island, and eastern Long Island, most dug quahogs or took out parties of tourists fishing and sailing on their catboats during the warmer months, while some in North Carolina pursued a series of seasonal fisheries including netting shrimp, trawling and potting blue crabs, trawling for flounders, and catching finfish with pound nets and haul seines (Smith²).

Part-timers comprised the other category of bay scallopers (Fig. 60). Most were painters, plumbers, store clerks, police officers, potato farmers (in New York) and, in the late 1800's and early 1900's, even livery stable workers (Anonymous, 1895d). The part-timers entered the fishery only in the years when scallops were relatively abundant and easy to harvest. They pursued the fishery for the first 2-4 weeks of a season, and at this time their numbers could far exceed those of the regulars. After the 1940's, the part-timers also included men who regularly caught sea scallops, *Placopecten magellanicus*, and finfish on ocean-going boats. The

RECREATIONAL SHELLFISHING

(Shellfish & eels taken under permit shall not be sold or offered for sale.)
(summary of regulations listed on backside of permit)

Quahogs: April 1-March 31
Limit: Not over one ten-quart bucket in any one day and not over 1/2 bushel per week. Quahogs must be 1 inch thick at hinge.

Mussels: April 1-March 31
Limit: One bushel per week.

Eels: April 1-March 31
Can be taken from Madaket ditch by dip net with mesh measuring more than 1 1/2 inches only.

Oysters: September 1-April 3
Limit: Not over 1/2 bushel per week. Oysters must be 3 inches in length.

Scallops: October 1-March 31 (Wed-Sun only)
Limit: One bushel per license per week. Bay scallops must have well defined raised growth line to be legally harvested.

Soft Shell Clams: Season closed June 15-September 15
Sundays only March 31-June 15
Sundays only September 15-December 15
Saturdays & Sundays December 15-March 31
Limit: One ten-quart bucket only in season. Clams must be 2 inches long. Any clams under 2 inches must be replanted, neck upright and covered with a layer of sand.

Recreational shellfish permits are issued April 1-March 31 to coincide with the dates of scallop season. Commercial scallop season is open November 1-March 31.
Resident fee \$25.00.....Non-resident fee \$100.00.....Commercial scallop fee \$250.00

Figure 56.—The list of regulations that cover the recreational harvesting of shellfish and eels, Nantucket, Mass., 2006.

part-timers, who worked in the towns, earned more money/week, perhaps by 50%, scalloping than they had been earning/week in their regular jobs.

The numbers of part-timers in the fleets were relatively small during the first decades of the 1900's when catboats were the common vessels (some were mates on 2-man boats), but their numbers increased sharply after the late 1940's, when outboard motors became available to propel wooden rowboats. During the years when scallops were abundant, the numbers of regular fisher-

men, part-timers, the openers, and other workers (packers in fish houses and delivery men) comprised from 10 to 50% of the workers in the smaller communities. The part-timers have also been able to enter the fisheries for softshell clams, quahogs, and oysters, but far fewer have done it because they are not as lucrative.

The bay scallop fishery was easy to enter because the types of boats, especially rowboats and dories, that fishermen have used were common around waterfronts, and also minimal

skills were required to harvest scallops. Scooping scallops with a net, hauling and dumping the contents of dredges, culling the scallops from grasses, shells, crabs, conchs, and seed scallops and then opening the scallops were all easy-to-do processes. Only the hauling of dredges hand-over-hand, and carrying a few baskets and bags of scallops from boats to opening places required any heavy work. The harvesting beds could be found by observing where the regulars were dredging.

Beginning in the 1930's, some wives went on the boats with their husbands so the couple could get a double limit of bay scallops. Improved oil clothes and better cold-weather clothing including gloves made this possible for women (Fig. 61a, b, c, d, and e). The husband operated the boat, hauled, emptied, and tossed out the dredges while the wife stood on the opposite side of the culling board and picked out the scallops, tossed them into baskets, and pushed the shack overboard.



Figure 57.—Harvesting bay scallops in Westport River, Mass., 1950's. These 12 to 14 ft (3.7–4.25 m) boats had one or two fishermen; if two comprised the crew, one ran the outboard motor and hauled in the dredges while the other culled the scallops from the 'shack.' Such boats and crews were the common harvesters of northern bay scallops during the late 1940's to 1970's. Photograph courtesy of Gary Sherman.



Figure 58.—Nantucket fishermen leaving for the beds at dawn. They will be striving to harvest their daily limits of scallops, 1990's. Photograph courtesy of J. Powers, *Inquirer* newspaper, Nantucket, Mass.

Most of the same men (and women) and boats comprised the bay scalloping fleets in a town each year, but some younger men were joining and some older men and others were leaving the fleets. Some young men began their careers as scallopers by using the second-hand boats, outboard motors, and dredges owned by a relative, such as an uncle, and later purchased better equipment as they needed it (Warnke²⁰).

Each fall, before the seasons opened, unofficial fishermen surveys of bay scallop abundances were made. News of the results spread rapidly to about every household in the communities because interest in the size of the year's scallop crop was high: A large quantity of money might be entering the economy. This word-of-mouth news alerted the part-timers and helped them decide whether to go scalloping. It was common for two part-timers to purchase a wooden rowboat, a second-hand outboard motor, and two dredges so they could harvest together. They were able to pay for the purchases with the money they obtained from their scallop sales within a week of harvesting.

During the few weeks of a scallop season, the part-timers took the bulk of the bay scallops from the beds, referred to as the "cream." The full-time fishermen then had a harder struggle to get their limits and make a good day's pay in the weeks that followed because only the "scraps" remained. The full-timers slightly resented the presence of the part-timers, but they had become used to them.

In many of the good years as winters wore on into January and February, most of the full-timers gradually quit scalloping because the catches became too small to provide a day's pay, but in the good years some "die-hards" harvested scallops into March. As fishermen became older, they found that scalloping dragged them down physically and also mentally when they were on the scallop beds near the end of a season, especially when their families needed money and few scallops were available to harvest (Willis⁸).

Different attitudes prevailed among the fishermen regarding harvesting large or small bay scallops. The large scallops brought the fishermen more money, but the small ones usually were more abundant and limits could be obtained earlier in the day. Some went after the small ones so they could get in early and spend most of their time opening indoors.

In the latter half of the 1900's, the bay scallop fishermen got to the harvesting beds in one of three ways. Some had their boats tied to docks or stakes along the harbors' edges. They drove their vehicles from home to the docks, a distance of perhaps 1–3 miles (1.8–5.4 km), and got aboard their boats tied at the docks or to the stakes a short distance from the dock, getting to those by their rowboats. Upon leaving the stakes, they left their rowboats tied to them. The second way was to drive their vehicles to the shores of bays and harbors and get into their small boats that were hauled onto the edges of shores. The third way was to launch their boats daily and haul them out on their trailers to park over night at home (Fig. 62). The distances to the scallop beds ranged from 0.5 to 3 miles (0.9–5.4 km) with a traveling time of 10–20 minutes. As winters grew colder and the first ice formed around their docks, the fishermen had to break through it to get to open waters and the scallop beds. The scallopers in Buzzards Bay, at times, hired a tugboat from New Bedford to break the ice out of a channel (Hiller, no date).

The lengths of bay scalloping seasons depended upon scallop abundance and also on how long ice covers during mid winter prevented scalloping (Fig. 63a, b). In some seasons, the scallops were so scarce that only the regular fishermen sought them. The 1916 scalloping season in Massachusetts was so poor that it was considered a failure, and it meant the loss of many thousands of potential dollars in revenue to the Cape Cod towns of Chatham, Harwichport, Dennisport, and South Yarmouth. The owners of boats turned their attention to cod fishing which began a little later than the opening of the scalloping season (Anonymous, 1916c).

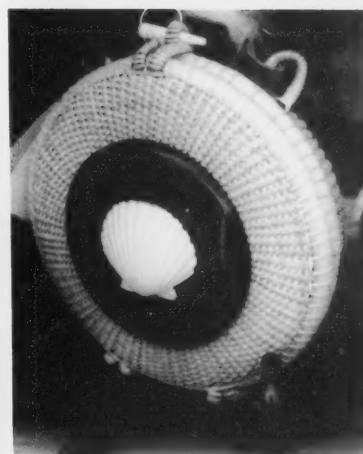
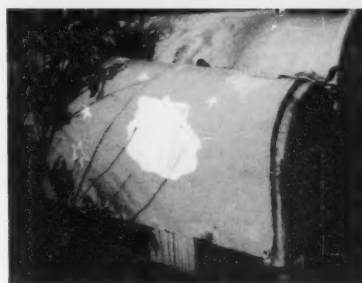


Figure 59.—The attractive design of the bay scallop shell has been used to beautify many things, Nantucket, Mass., 2006.



Figure 60.—Large fleet of boats dredging for bay scallops in Peconic Bay, N.Y., late 1970's–early 1980's. Photograph courtesy of Debra Barnes, New York State DEC.

The First Decades

The first accounts of the bay scallop fishery and the major bay scallop market, i.e. New York City, were written by scientists and reporters for the *Fishing Gazette*, *Frank Leslie's Illustrated Newspaper*, and similar publications. Ingersoll (1886) wrote one of the first

which he published in the *American Scientist*:

"The bay scallop first appeared in the New York markets as an edible food in 1858 or 1859. It then became sold in them every year since. The annual supplies are highly variable. Total production is about 75,000 gallons (100,000 bushels of unopened scallops)



Figure 61a.—Women scallopers in Oak Bluffs, Mass. lugging their harvest up the beach to their automobile, 1950's.



Figure 61b, c, d, e.—Women helping their husbands cull bay scallops, Peconic Bay, New York. Photographs courtesy of Debra Barnes, New York State DEC.

with a value to the fishermen of \$25–30 thousand. New York City receives about 3/4ths of the landings. About 250 men and 470 women (in total) are engaged in the fishery as harvesters and preparers of the scallops for markets.

“The scallop fishery exists only between Cape Cod and New Jersey, except at a few locations southward as far as Morehead City, N.C., for a small local trade. The fishery was regularly

pursued only in Buzzards Bay, Narragansett Bay, and in Peconic Bay, Long Island (note: Ingersoll was not aware of scallops off the south coast of Cape Cod, and on Martha's Vineyard, and Nantucket). Long Island Sound, Raritan Bay, and much of the New Jersey shore once had some scallops, but they

have become scarce. Scallops at times are present here and there, but only temporarily. The Long Island Sound scallops became scarce because the fishermen did not throw the seed scallops back to the beds. The same was true in Raritan Bay and along the New Jersey coast.

“The scallops are caught by hand-dredging from small sail boats. The dredges are about 30 in (75 cm) wide and on windy days several are towed from each boat. In shoal water, a dip-net is used to gather the scallops on calm days.

“The scallop openers are men, women, and girls, who earn from \$0.80 to \$1.25/day. The scallops' “eyes” (adductor muscles) are flipped into a basin of yellow stoneware which holds a gallon. They are then poured into a large colander, thoroughly washed, placed in clean boxes and shipped to New York City and Brooklyn. As little fresh water or ice is placed in contact with the meats as possible so as not to weaken their firmness and flavor. Since this is done in winter, ice usually is not needed in transportation. Local farmers took some of the refuse (shells and “guts”) to spread on their fields as manure; they plowed in the shells.

“Oyster planters also took the shells to spread on their seed beds as cultch; they paid \$0.03–0.05/bu for them.



Figure 62.—The bay scallop fishermen in Lagoon Pond, Vineyard Haven and Oak Bluffs, Mass., launch and haul out their boats daily, 2006.

The oyster planters preferred scallop shells to oyster shells because, being thin and fragile, they break under the strain produced when the oysters grow. It gives the oysters room to grown in an oval shape."

An article published in 1897 (Anonymous, 1897b) reflected upon the bay scallops near the end of the 1800's: "When one considers that half a century ago the toothsome scallop was eaten only by a few local people, and was entirely unknown in the great markets, it is a matter of surprise to note their popularity in the seaboard towns, and also the large number of men who now make a good living by capturing this deservedly favorite mollusk, which seldom reaches markets far inland for two reasons—the shell is too fragile for shipment even if the "meat" would keep long out of water, and the second reason is that the demand in the seaboard cities is greater than the supply. The scallop became a favorite in the cities, and consequently a profitable object of pursuit less than 25 years ago."

In the late 1880's and early 1900's in New York City restaurants, bay scallops fried with bacon was the most popular way this mollusk was served, although it was sometimes broiled or stewed. In New York restaurants, the order termed "half and half" was often given, which meant oysters and scallops, or it was sometimes: "A fry, half scallops." A "fry" referred to oysters (Anonymous, 1903a).

Landings and Prices

Historical data on the annual quantities of bay scallops landed and their landed dollar values by year are available from the report by Lyles (1969) and the NMFS Statistics Division, Wash., D.C. The quality of the data is somewhat poor, because they were collected by shellfish officers who could make only rough estimates of the landings. Considering all the states from Massachusetts through North Carolina together, landings were first recorded in 1880, when 49,000 bushels of live scallops were tallied. Subsequent landings were recorded nearly every



Figure 63a.—The Nantucket, Mass., scalloping fleet is iced in, Feb., 1920's. Photograph courtesy of Nantucket Historical Association.



Figure 63b.—A partial ice cover over Nantucket Harbor, Mass., hindered scalloping, 1920's. Photograph courtesy of Nantucket Historical Association.

year. From 1880 to the late 1990's, they ranged from 21,000 bushels (in 1889) to 386,000 bushels (in 1971). The decade of the 1920's produced an average of about 110,000 bu/yr, but afterward the landings were 2.5–3.3 times larger: an average/yr of 370,000 bushels in the 1930's; and an average 290,000–300,000 bu/yr in the 1950's and 1970's. From 1980 to 1985, they averaged 294,000 bushels/yr, whereas in three 6–7-year periods afterward, they fell steadily. In 1986–91, landings

averaged 80,105 bu/yr; from 1992 to 1997, they averaged 60,000 bu/yr, and from 1998 to 2005 they averaged 30,000 bu/yr (NMFS landings statistics).

Over time, the landed prices (uncorrected for inflation) of bay scallops have risen. The prices/gal (= 8 pounds) were from \$0.80 to \$1.70 in the late 1800's, and averaged \$2.10/gal in the 1920's, \$1.85/gal in the 1930's (*Fishing Gazette* articles), \$7.00/gal in the 1960's, \$15.00/gal in the 1970's, \$42.50/gal in the 1980's, \$90/gal in the early

2000's, and \$15/lb, or \$120/gal in 2006 (Sayles¹²; Bourguignon¹⁵; Wenczel²¹).

The total bay scallop supply from all the coast-wide production areas was the main influence over the landed price each year. In seasons when many bays in Massachusetts, Rhode Island, and New York had large harvests, the landed prices were consistently low; on the other hand, small crops usually meant higher prices. The average price in one year could be as little as half of that of the previous year. Wholesale marketers controlled the landed prices of bay scallops and the fishermen have been mostly powerless to affect them (Belding, 1910).

Marketing

In the late 1880's and early 1900's, when the scallop industry had developed, scallop meats were shipped by railroad express to New York City from many harvesting ports from Massachusetts to North Carolina. They were packed in tubs that held from 40 to 80 pounds of meats (Anonymous, 1919a). In the New York City market, bay scallops then were handled in large, medium, and small size categories. The price difference per gallon between the sizes was large (source: articles in *The Fishing Gazette*):

Year	Large	Medium	Small
1913 (Month ?)	\$2.35	\$1.85	\$1.50
1915 (Jan 23)	2.75	2.25	1.00
1916 (Dec. 16)	3.25	2.75	1.85

The grading of scallops into sizes did not endure. It has not been practiced since the 1940's and maybe before that. A batch of bay scallop meats usually has some that are nearly white and some with faint tinges of orange and yellow. Though the scallops were never sorted by color shades, the meats with such tinges were not favored. Some customers would not purchase the scallops unless their "eyes" were as white as the inside of the scallop shell (Anonymous, 1910a).

²¹Wenczel, P. Shellfisherman, Greenport, Long Island, N.Y., Personal commun., 2006.

Soaking Meats

In the first decades of the fishery, wholesale buyers commonly soaked bay scallops in fresh water for several hours to increase their volume before shipping them to markets. Five gallons of freshly opened scallop meats swelled to about seven gallons. Soaking whitened the meats, diluted their flavor, and caused the meats to fragment slightly. The soaking practice was forcing customers to pay the fancy price for some added fresh water (Anonymous, 1915b). Dry (unsoaked) scallops were slightly smaller, the meat was solid, the full flavor was retained, and though retailers charged more for them they sold more readily than the soaked scallops (Anonymous, 1917a).

In about 1915, the U.S. Department of Agriculture, under section 7 of the Food and Drug Act, ruled that it was unlawful in interstate commerce to ship or sell bay scallops to which water had been added, either directly or from melting ice. Such food was considered adulterated. Government agents could easily detect soaked scallop meats because they would be lying in milky water that had drained from the meats. Milky water was missing in the containers that held dry scallops. Health officers found that polluted water often was used, and whenever some fishermen had the practice of opening the scallop meats into cans containing fresh water, the cleanliness of the cans and the water came into question.

The fishermen and shippers who had practiced soaking rebelled against the ruling because it meant less money for them. But Massachusetts, Rhode Island, and Connecticut shippers had to abandon the practice, because the soaked bay scallops were being seized and destroyed enroute to and in New York markets. This had followed notices that soaked scallops were liable to confiscation when shipped in interstate commerce. The ban did not apply to scallops harvested on Long Island, N.Y., since they were shipped to the New York market from within the state (Anonymous, 1915a).

Factors Affecting Market Supplies and Prices

The sizes of bay scallop landings were affected by poor weather, and scallop prices could be affected by factors other than the total supply available. Those factors included the regional quantity being produced, competition from supplies of soft crabs and shad, *Alosa sapidissima*, a weaker demand at Thanksgiving, and (once) a railroad strike.

Weather and Landings

In the early 1900's, the *Fishing Gazette* commonly reported that bay scallop supplies in the New York market were low for several days at a time because the fishermen could not harvest scallops. Wind storms, several or more days with only slight winds, and also ice covers could keep the fishermen ashore as the following three examples illustrate. On 30 October 1915, strong coastwide winds during the week had prevented the taking of bay scallops along the entire east coast: Massachusetts, Rhode Island, Long Island, Virginia, and North Carolina (Anonymous, 1915g). In contrast, in November 1920, the supply was short because calm weather prevented the sailboats from harvesting (Anonymous, 1920). During cold periods, especially in January, an ice formation over bays often halted scalloping for 3–6 weeks (Anonymous, 1895a; 1916a).

Some hurricanes negatively impacted the bay scalloping fishery. They damaged some boats, wrecked shanties, and destroyed some sections of eelgrass meadows, some scallop stocks, and altered bay openings.

Too Many at Once

During the first few days of September when the bay scalloping season began, consumer demand was high because the scallops were a novelty in markets. But the price dropped quickly as large supplies came in from several bays (Anonymous, 1936). Massachusetts' *Fairhaven Star* (16 Oct., 1910b) described a price drop during the first few days of the 1909–10 season: "A large supply of scallops from Cape Cod

was responsible for the falling price. On the first day, the fishermen received \$2/gal, the second day \$1.25/gal, and eventually only \$0.80/gallon." And in 1915, the season opened with scallops selling at \$2.00/gal, but within 2 days, the price fell to \$1.25/gal and remained at that figure. At times, prices were so low, they hardly met the costs of production. However, in 1914, a year of relatively small stocks, the scallop price had reached \$5.00/gal, and it remained at about that figure for several weeks (Anonymous, 1915c).

When the season opens, fishermen have hoped that the bay scallops in their local bays were abundant but were scarce in the other producing areas so the prices of their scallops would be relatively high. It was "sour news" if other locations had large crops. For instance, an Anonymous (1919a) article in the *Fishing Gazette* said, "The present week has certainly been a poor one for those who expected to make a fortune out of scallops. Seldom in the past has there been such a plentiful supply in the east as during the past 10 days, and there has been a run of low prices which have not been seen here in 5 or 6 years. The largest scallops which in 1918 and during 1917 sold for as much as \$6-7/gal, this week were on sale at \$3.00-\$3.50/gal. There are indications of cold weather and, when a heavy frost comes, there will be a freeze-up with an accompanying cutting down in the supply. Then look for higher prices."

Competition from Soft Crabs and Shad Roe

The combined presence of softshell blue crabs, shad roe, and bay scallops in the New York markets led to competition amongst them for customers' dollars. Soft crabs were available in the markets during the warm months, beginning on about St. Patrick's Day (late March) and lasting into fall. When scallops arrived in the market in September, the price of the softshell crabs fell. Near the end of the scalloping season in late March, soft-shell crabs came into the market again as did shad roe. The crabs and shad roe could bring an end to the scallop season as prices for scallops fell due to the

competition (Anonymous, 1916b). An article in the *Fishing Gazette* (Anonymous, 1915c) described prices near the beginning of the 1915 bay scallop season: "The present bay scallop season probably is one of the poorest that the Long Island fishermen have known in a long time, the supply of stock being much greater than the demand, with prices so low that they hardly pay costs. Many feel that scallops will be higher in price as soon as soft crabs are out of the market."

Thanksgiving

The demand for bay scallops, at least in the Boston market, was low during the week of Thanksgiving at the end of November, when people had the tradition of purchasing oysters and northern quahogs. Scallop prices were noticeably lower then (Anonymous, 1915h). This trend continues today (Whittaker⁴).

Railroad Strike Problems

In 1919, the employees of the Railway Express Agency went on strike, meaning that the railroad transport of bay scallops and other fishery products to the New York City market ceased. The U.S. Mail Service, that began operations in 1912, was asked to transport the fish, and, oddly enough, scallops had the honor of being the first type of marine product to be so shipped. They were packed in water-tight tubs that weighed 40-80 pounds. Special delivery stamps were used to pay the shipping fee, and the scallops reached markets quickly (Anonymous, 1919a).

When the railroad strike ended, most bay scallopers and shippers returned to using the railroad. The wholesale fish dealers believed that shipping the scallops by Parcel Post had induced the Express Agency to do better, since they now had a real rival. They would not allow the scallops to remain in their terminals any more (Anonymous, 1919a).

Higher Prices for Northern Than for Southern Bay Scallops

Bay scallops, *A. i. concentricus*, from Virginia (Eastern Shore area, oceanside) and North Carolina, termed "Southern

scallops" collectively in the New York City market, sold for substantially lower prices than did northern scallops, *A. i. irradians*, from the northeastern states. As examples, in January 1915, large dry (unsoaked) bay scallops from the northeast were \$2.50-3.00/gal, mediums were \$2.00-2.50/gal, smalls were \$1.00/gal, and southern scallops were \$1.25-1.50/gal (Anonymous, 1915a). In January, 1916, large dry bay scallops were \$3.00-\$3.50/gal, mediums were \$1.75-\$2.50/gal, smalls were \$1.25-\$1.50/gal while southern scallops were \$1.00-\$2.00/gal (Anonymous, 1916a).

Bay Scalloping: Individual States

Massachusetts

Massachusetts has produced more bay scallops than the other states because it has much larger producing areas (Fig. 64). The scalloping grounds have comprised thousands of acres, many of which were once covered with eelgrass. The recorded annual landings of bay scallops shortly before and after 1900 usually were from 40,000 to 80,000 bu/yr, but from about 1920 to the mid 1980's, they were much higher—from 130,000 to just over 200,000 bu/yr in most years. The installation of motors in the harvesting boats is the main reason for this increase. The landings ranged from 56,000 bushels in 1963 to 296,000 bushels in 1972. Since 1985, the landings have fallen much lower (Table 2).

The scallops are found in many of the state's bays, including those on islands of Martha's Vineyard and Nantucket, and also in some coastal areas along the

Table 2.—Bay scallop landings in bushels (avg/time period) from four towns or islands in Massachusetts. Westport borders on Buzzards Bay, Chatham is on Cape Cod, while Martha's Vineyard and Nantucket are separate islands. The data are in six 5-yr periods from 1976 to 2005 (from local town annual reports).

Period	Westport	Chatham	Martha's Vineyard	Nantucket
1976-80	6,800	33,200	23,800	63,300
1981-85	13,750	25,500	34,300	66,100
1986-90	200	700	24,900	28,500
1991-95	100	500	7,900	14,500
1996-2000	780	300	6,200	8,800
2001-2005	70	400	9,600	12,500

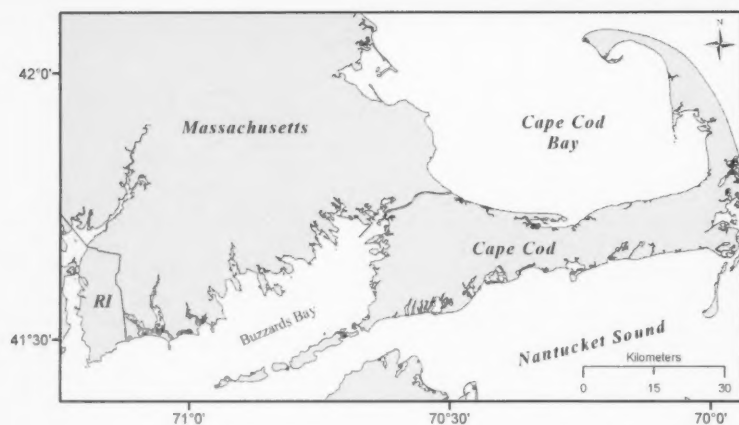


Figure 64.—Southeastern Massachusetts. Southern Martha's Vineyard and Nantucket are not shown.

south shores of Cape Cod and in Buzzards Bay. Some occur in southeastern Cape Cod Bay. Nearly all the bottoms consist of hard sand and most are in water 4–8 ft (1.2–2.4 m) deep.

Massachusetts laws regarding bay scallops were formalized in February 1910 (Table 3). Scallop fishermen have been allowed to harvest bay scallops and other estuarine bivalves only within the borders of the towns in which they are legal residents, a rule in effect since in the late 1800's (Anonymous, 1885b). Thus, the towns retained their resources for their citizens. The state has overall jurisdiction over the bay scallop fishery. It sets the broad limits of the harvesting season, and daily harvests/fisherman, and it rules that only scallops contain-

ing an annual ring on their shells can be harvested. The state's General Shellfish Act of 1880 entrusted all regulation of the shellfisheries to the town selectmen, who fine-tuned the state laws to the needs of their communities (Belding, 1910). Specifics, such as license fees, minimum temperatures in which scallops can be harvested, daytime hours, days/week, catch limits, and seasonal dates for harvesting are governed by the towns (*Martha's Vineyard Magazine*, Winter, 1988).

Since the late 1800's, the commercial fishermen had to purchase a license to harvest bay scallops and other mollusks. The towns initially charged about \$1.00 for a seasonal license (Anonymous, 1890), but the fee has since risen, and

was \$2.00 in the early 1900's (Anonymous, 1910b) and in recent years as much as \$250/season in some towns. The selectmen usually rule that scallop harvesting is not allowed when temperatures are lower than 28°F (–2°C) to prevent the scallop seed from freezing to death (MacKenzie, 1992).

Massachusetts initially did not limit the daily bay scallop harvests of its fishermen. In 1887, boats got as many as 50–80 bu/day (Anonymous, 1915f). In 1895, a state limit was set at 25 bu/man/day (Anonymous, 1895c; Ryder, 1934). In later years, the limit was reduced to and remains at 10 bu/day. Towns went along with the state ruling until the economic depression of the 1930's, when they reduced it to ease some of the strain of unemployment. With the smaller limits, the scallopers could harvest and obtain money for a longer time each season (Poole, 1965). As examples, Westport and Bourne had a 7.5-bushel limit; Marion and Wareham, a 7-bushel limit; and Yarmouth, a 5-bushel limit. In the towns on Martha's Vineyard, limits were reduced to 2–4 bushels. The limits were large enough for fishermen to earn a living wage. Edgartown currently has a limit of 3 heaping baskets (3 level bushels, plus 3 pecks)/day (with a yield of 20–30 pounds of meat), and Nantucket has a limit of 5 bu/day.

During the first several decades (including most of the 1950's) of commercial bay scalloping, the fishermen were allowed to harvest 6 days/week, Monday through Saturday, but afterward the towns reduced the fishing week to 5 days, Monday through Friday. This lengthens the season and also eliminates from the fishery many of the part-timers who fished only on Saturdays (Kilburn, 1986). When the scallopers miss a weekday because the temperature is too low, they are allowed to harvest on the next Saturday, if the temperature is sufficiently high.

A form of "piracy" by fishermen was the taking of more bay scallops in a day than the limit allowed. A small number (1–2%) of scallopers in each town consistently took from 1 to 4 pecks of scallops/day above the limit. They had to dodge the wardens to be successful

Table 3.—Massachusetts laws pertaining to the harvests of bay scallops.

Section 1. It shall be unlawful to take from the flats or waters of the state seed scallops, or to sell or offer for sale, or have in possession such scallops so taken. For the purposes of this act an adult scallop shall be a scallop with a well-defined annual growth line. Scallops taken from the tide waters of the commonwealth shall be culled out when taken, and all scallops besides adult scallops so taken shall immediately be returned alive to tide water which is at least 3 ft (0.9 m) deep at low water, but the provisions of this section shall not apply to scallops besides adult scallops unavoidably taken; provided that the number taken at any one time does not exceed 5% of the total catch after being culled as herein provided. All scallops taken in accordance with the provisions of this act shall be landed ashore in the shell. A seed scallop has a bright, thin, slightly curved shell, with no foreign growth adherent, the shell having no sharply defined growth line, and the animal being less than one year old.

Section 2. No person shall take scallops between the first day of April and the first day of October from the flats or waters of the Commonwealth, or buy or sell or have in possession scallops so taken; but the provisions of this section shall not apply to the taking of scallops for bait in the waters adjacent to the town of Nantucket, from the first day of April to the 15th day of May, inclusive, nor shall they prohibit any person at any time from taking scallops for food for his own personal or family use.

Section 3. No person shall take more than 10 bushels of scallops including shells in any one day.¹

Section 4. Whoever violates any provisions of this act shall be punished by a fine not exceeding \$25. Possession of seed scallop, except as otherwise provided in section 1, shall be prima facie evidence that such scallops were taken contrary to law.

¹In the late 1880's, Massachusetts had limited the daily harvest of bay scallops to 15 bu/fisherman (Anonymous, 1889b); the limit was reduced to 10 bu/man/day in 1910.

(Fig. 65). The honest scallopers quietly resented these acts of the few, but rarely mentioned them to wardens (Sherman⁹; Bourguignon¹⁵).

The fishermen did not take seed scallops because it was illegal to do so and they were too small to be opened, but, in 1893, some New Bedford finfishermen knowingly harvested some seed and adult scallops illegally at night to avoid detection. They mashed them, put them in coarse bags, and sank them on their fishing grounds to attract fish. They caught more scup than the other fishermen (Anonymous, 1893a).

Preservation of Resources

Town officials have attempted to support their bay scallop fisheries by hiring shellfish officers, or wardens as they are often termed, to enforce the limit and seed rules and to keep a close eye on the conditions in the beds and advise the officials about the status of the scallops and other shellfish (Fig. 66) (see Lind, *In press*). Each town has one main officer and often at least one assistant. The Massachusetts shellfish officers now belong to the Massachusetts Shellfish Officers Association (MSOA). The group meets once every 3 months at sites around the state, to hear about activities and various rulings by the State Division of Marine Fisheries that might affect the bivalves in each town and to hear lectures by marine biologists. When on duty, they wear a uniform with a patch on the sleeve bearing the town's name. The cap they wear has MSOA embroidered on it.

The officers can be involved with other types of management. At times, sections of bays with large quantities of seed scallops have been closed to harvesting of market scallops, seed in poor locations (mostly shallow beds exposed to storms) or washed ashore have been transplanted to areas where they can survive or grow better, and attempts have been made to control starfish, based upon recommendations of the wardens. During the 1930's Depression, some Massachusetts towns paid scallop fishermen to dredge starfish from the grounds. They paid them \$0.25/bu, the money coming from the National

Federal Works Progress Administration. The starfish were taken by farmers to fertilize their fields. The towns usually appropriate only small sums of money for management projects.

Some towns, such as Nantucket, allow the fishermen to use only small scallop dredges, that are without pressure plates (Fig. 67). The purpose is to prevent dredging from doing extensive damage to the bottom habitat.

Evolution of the Fishery

In Massachusetts, bay scallops were first harvested on a commercial scale in 1874, when the dredge was introduced (Belding, 1910). Before that, the scallops were gathered only by hand or with dip nets or rakes in shallow water, or from beaches when storms had washed them ashore. Some farmers waded into the shallows and gathered them with scoop nets to feed their chickens, scattering them unopened in the chicken pens (Palmer⁶; Pierce¹⁰). As an article of food it was barely known, but people

were aware of its highly colored, pretty shell.

Statewide, the fishery began slowly, and in the early 1890's little market existed for scallops, people were not used to eating them, the harvesting gear was inadequate, and ice was not readily available to preserve the meats for shipment to markets (Belding, 1910). Transportation from the bays to shucking sites progressed with time. In the late 1800's,



Figure 65.—A Massachusetts shellfish officer holding a seed bay scallop he found in the harvest of this fisherman. Massachusetts fishermen can have no more than 3% seed, by count but not volume, in relation to the total scallop harvest. Fishermen rarely take many seed.



Figure 66.—Town of Oak Bluffs, Mass., shellfish officer has the design of the bay scallop on his jacket.

only worn paths existed near most scalloping areas. Some scallops harvested at distances from the fishermen's homes

and waterfront shanties were pulled to them for subsequent opening on sleds or carts by horses or oxen (Poole, 1965). At

least by 1889, school boys were doing some of the scallop opening, being paid \$0.15–0.25/gal. Fishermen then received \$1.20–2.00/gal for the meats (Andrews, 1990).

In the 1920's and into the 1930's, the buyers in some towns drove their trucks to the shores to pick up the scallops from the fishermen, who did not have automobiles, and take them to their fish houses for opening. By the 1950's, fishermen carried the scallops on their pickup trucks, trailers (Fig. 68), or in automobile trunks (Fig. 69) or on the bumpers.

The Bay Scalloping Towns

Belding (1910) listed 14 Massachusetts towns that had commercial-sized bay scallop fisheries (Table 4): Barnstable, Chatham, Harwich, Dennis, and Yarmouth on the south shore of Cape Cod (Fig. 70); Fairhaven (Fig. 71), New Bedford (Fig. 72), Mattapoisett, Marion, Wareham, Bourne, and Falmouth in Buzzards Bay; Edgartown (Fig. 73) and Vineyard Haven on Martha's Vineyard, and Nantucket (Fig. 74a, b, 75, 76). The range in numbers of active scallop harvesters among the towns was from

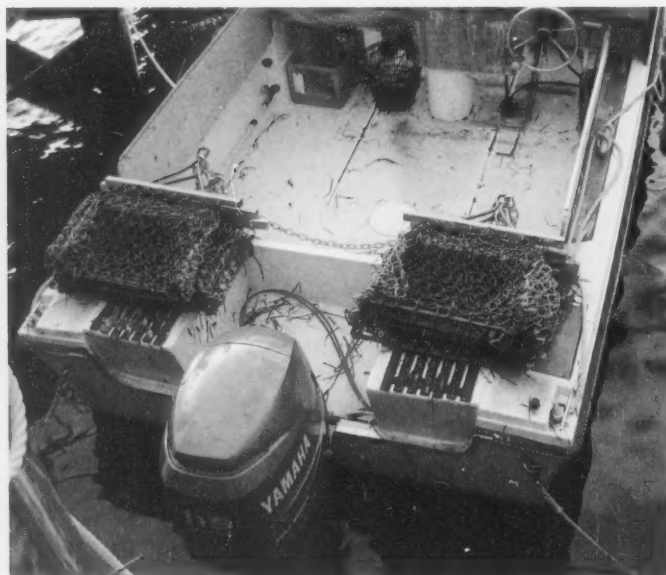


Figure 67.—By regulation, the Nantucket, Mass., scallop dredges must be light in weight and cannot be pan dredges. This rule is in place to protect the scallop beds from damage.



Figure 68.—Some fishermen carted their harvest of scallops home for opening on their towed trailers, Edgartown, Mass., 1950's.

Figure 69.—The trunk of an automobile was suitable for transporting bay scallops from the shore to an opening site, Edgartown, Mass., 1950's.



Table 4.—The number of scallop boats in the towns of Massachusetts, 1907–08 season (Belding, 1910).

Area and town	Boats	Landings (bushels)
Buzzards Bay		
New Bedford	20	930
Fairhaven	50	1,730
Mattapoisett	19	1,010
Marion	16	770
Wareham	36	1,730
Bourne	30	1,600
Cape Cod		
Barnstable	23	2,035
Yarmouth	15	10,640
Dennis	9	3,924
Harwich	7	2,890
Chatham	35	46,040
Martha's Vineyard		
Aquinnah (Gay Head)		
Menemsha Tisbury	8	4,000
Oak Bluffs		
Edgartown	26	22,610
Nantucket	47	26,930

12 to 107 men (46, avg.) during the 1907–08 season. Total scallop production in that season was 8,200 bushels from Cape Cod, 6,000 bushels from Buzzards Bay, 3,300 bushels from Martha's Vineyard, and 3,400 bushels from Nantucket. Beyond Belding's list, the towns of Wellfleet and Eastham in southeastern Cape Cod Bay, Westport and Dartmouth on Buzzards Bay; and on Martha's Vineyard, the towns of Oak Bluffs, Chilmark, and Gay Head (now Aquinnah) have produced commercial scallop harvests (Whittaker⁴).

Once underway, the bay scallop fishery became important economically and culturally (Fig. 77, 78). In the early 1900's, it was recognized as a source of great "profit" to the state's coastal towns (Anonymous, 1909). Every August and September, general community interest in the fishery was termed "scallop fever," as people were inquiring about the quantities of scallops that might be available in the forthcoming season (MacFarlane, 2002).

Within a particular town, a season could have a short duration if the bay scallops were scarce. When scalloping years were poor in the late 1800's, some fishermen found employment as laborers harvesting cranberries (Anonymous, 1899a). Some New Bedford men found employment in the city's mills and factories, while some fishermen in other Buzzards Bay towns had to fall back on the Overseers of the Poor for support (Anonymous, 1897a).

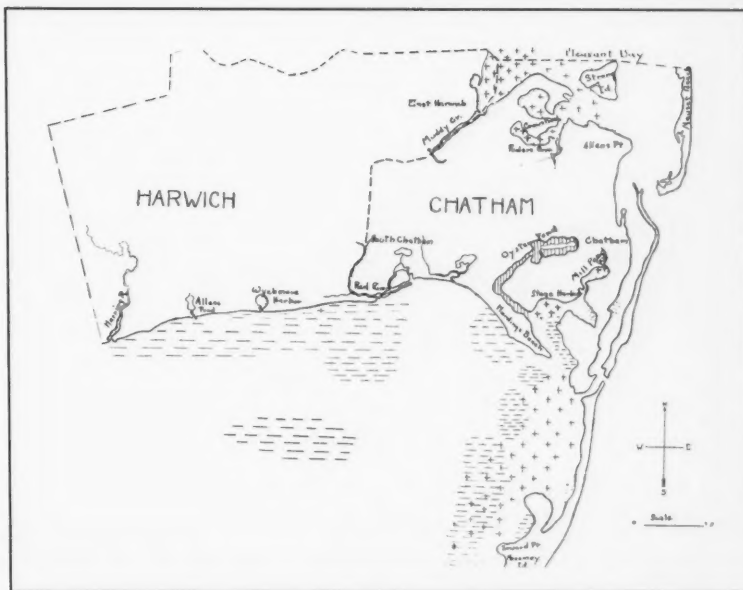


Figure 70.—The dashed lines show the distribution of bay scallops in the southeastern section of Cape Cod, Mass. The town of Chatham with at least 300 scallop fishermen harvesting in the good years often led all Massachusetts towns in bay scallop landings (Belding, 1910).

The harvests from a large bay scallop crop would bring an enhanced general economy for the town during the fall and winter, and people looked forward to having several scallop meals. The scallops were mostly fried and also cooked in casseroles and chowders. During the past few years, a small market for whole meats of bay scallops has emerged (Whittaker⁴).

Conflicts Between Towns

Conflicts arose in bays where a legal line that separated the territories of two adjoining towns divided beds containing scallops. Joint bays were most prevalent in Buzzards Bay and on Martha's Vineyard. In some years, a continuous scallop bed extended across such a line, the lines being identified by buoys and by shoreline points. In Buzzards Bay, conflicts between the fishermen in the adjoining cities of New Bedford and Fairhaven were common in the late 1800's and were described in the *Boston Daily Globe* and *Fairhaven Star*. Such conflicts were also common on Martha's

Vineyard, where Menemsha Pond, Lagoon Pond, and Sengecontacket Pond were shared by two towns each. Fishermen from one town often crossed the town line to harvest scallops from the adjoining town's beds, but usually were chased back by the local fishermen.

Composition of Fishermen

The Massachusetts bay scallop fishermen included regulars, who spent most of their working lives as fishermen in their town's waters, and part-timers. The part-timers included some children who went scalloping with their fathers before going to school. They were on the boats for about 2 hours, starting at sunrise, and some went during the school noon hour. They did not have to remain on the boats until their limits were harvested. Their fathers were allowed to harvest their full limits as well as his after they had left for school (Campbell²²). At the beginnings of good seasons, some boats

²²Campbell, B. F. Shellfisherman, West Tisbury, Mass., Personal commun., 2006.



Figure 71.—Landing bay scallops dredged in Nasketucket Bay (an extension of Buzzards Bay), Fairhaven, Mass., 1950's. Photograph courtesy of Spinner Publications, New Bedford, Mass.



Figure 72.—Landing bay scallops dredged in Clark Cove or New Bedford Harbor (extensions of Buzzards Bay), New Bedford, Mass., 1950's. Note the chain link and rings on the dredge, and the burlap bags used to hold the scallops. Photograph courtesy of Spinner Publications, New Bedford, Mass.

Fishing Fleet in Harbor, Edgartown, Mass.

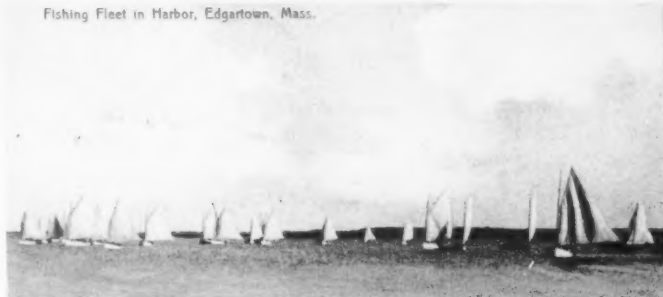


Figure 73.—Part of the catboat scalloping fleet in Edgartown, Mass., early 1900's. Photograph on postcard.

in Menemsha carried as many as four people each, two men and their wives, who qualified then for 4 limits. The wives went home after the first limits were obtained (Flanders¹⁴). The men who went scalloping with a boat owner and worked as his mate received 40% of the gross earnings from the sales of the scallops. The captain retained 10% of the mate's earnings to pay for fuel and boat expenses.

Part-timers have been able to enter the bay scallop fishery easily: They needed only a rowboat, drags, and, beginning in the 1940's, an outboard motor. Some people who did not initially have any equipment or previous experience were scalloping, as shown by the following details from Martha's Vineyard.

A bonanza season was awaiting in 1955, so a man and his pregnant wife borrowed an old skiff and 2 dredges, bought a second-hand outboard motor for \$75, and set out in a pond for scallops. The husband pulled in the dredges and emptied the scallops onto the culling board, while his wife culled them into baskets. They opened the scallops on a bench in their garage in the afternoons. Never having opened scallops before, his wife cut most in half before being taught how to open them properly, and each night she drove their car 5 miles (8 km) to the local fish market to sell the meats. One day, after scalloping for about 2 weeks, their outboard motor stopped running, and they drifted for about an hour until another fisherman

towed them ashore. The wife was not wearing adequate clothing, became cold and disgusted and she quit scalloping. That ended their season even though plenty of scallops remained on the beds (Mello Silva Jeffers¹⁹).

In the Massachusetts coastal towns, the carpenters received better wages than the other tradesmen and store clerks, and they earned more money than fishermen did during a year. But in the midst of a good scalloping season, the fishermen earned more money/day than they did. Many carpenters were tempted to go scalloping for a few weeks, but, fearing they could lose their jobs, few did. They were aware of the financial condition of the fishermen during poor scalloping seasons and also during the



Figure 74a, b.—Harvesting bay scallops in Nantucket, Mass., early 1900's (Belding, 1910).

times between every scalloping and quahogging season when the fishermen were often idle for a few weeks.

The 1938 Hurricane

The famous 1938 Hurricane that swept across Long Island and southern New England destroyed most of the bay scalloping shanties. The fishermen afterward had to open their scallops at home, in fish markets, and in a small number of newly constructed shanties. During the 1940's, fish market managers either drove to the fishermen's homes each night to obtain the scallop meats, weigh them using a scale on the truck, and pay the fishermen, or the fishermen drove them to the fish market for sale (Pierce¹⁰).

After the 1940's and perhaps before, the fish markets were charging the fishermen to use their space to open scallops. The opening houses in some towns disguised this by not charging a fee, but making fishermen sell a "gallon" that weighed 9 pounds, rather than its actual weight of 8 pounds. In these towns, the scores of fishermen who opened their scallops at home or in shanties at the docks also had to sell a gallon that weighed 9 pounds to the fish markets. In the remaining towns, the fishermen were charged either about \$1.00 for each of their 2-bushel bags for use of the opening space, a fee for each pound

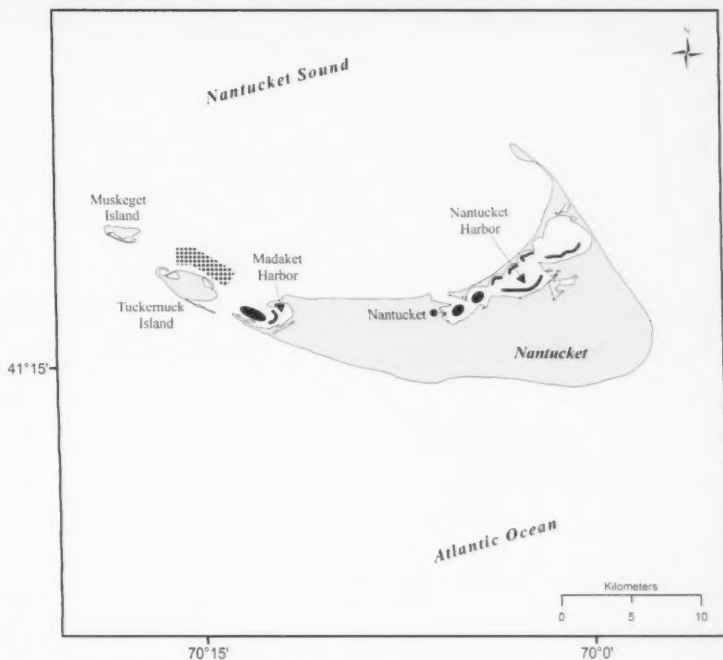


Figure 75.—Locations of the bay scallop beds on Nantucket, Mass. The hatched area north of Tuckernuck Island shows where large eelgrass meadows that used to harbor bay scallops once grew.

opened, or around \$10/week. They were paid for an 8-lb gallon (Warncke²⁰). Since the 1950's, Massachusetts has required that bay scallops be opened in state-approved opening houses, cellars,

or kitchens having hot and cold running water, toilets, smooth washable walls, cement floors, fiberglass bench tops, and stainless steel knives; stainless steel or plastic containers for the scallop



Figure 76.—Using the hoist to retrieve a bay scallop dredge in Nantucket Harbor, 2006.



Figure 77.—Left: The scallop design decorates an old gravestone on Nantucket, Mass.; Top: The scallop design decorates a gravestone on Martha's Vineyard, Mass.

meats are also required (Poole, 1965; Whittaker⁴).

Harvesting in Five Major Locations

During the 1907–08 season, the fishery in southern Cape Cod produced 64,000 bushels with 3/4ths of the total from Chatham, Buzzards Bay produced 48,000 bushels, and Martha's Vineyard and Nantucket combined produced 53,000 bushels of bay scallops (Belding, 1910).

Cape Cod Bay

Belding (1910) stated that between Plymouth and Provincetown in Cape Cod Bay, bay scallops could be obtained at Barnstable, Brewster, Wellfleet, and Provincetown, but no extensive fishery was carried on. The chief characteristic of this bay is a great rise and fall of tide, averaging about 10 ft (3 m). Vast areas of flats are exposed, and during winters the scallops die on them. The scallops were gathered by hand from the exposed flats, or by pushers and dip nets in the shallow water. No regular dredging took place.

Since then, only spotty commercial scalloping has taken place. It has never been a substantial fishery. In the fall of 2006 and 2007, the scallop crop was sufficiently large to support a small fishery in Wellfleet and Eastham in eastern Cape Cod Bay. The scallops were located in 5–25 ft (1.5–7.6 m) of water, the beds have some eelgrass, and the water is relatively clear. In Wellfleet, the season opened during the first week of October. Shellfishermen wanted to begin the scalloping season in October rather than in November when most locations begin, so they would have little competition in the market and be assured of high prices. From 2 to 10 boats sought scallops every suitable day. The boats are about 40 ft long with inboard engines and hulls of wood or fiberglass. The daily limit is 10 bu/man or 20 bushels for a boat with two licenses. The scallops are opened in the fishermen's homes (Mankevetch²³).

²³Mankevetch, J. Assistant shellfish officer, Wellfleet, Mass., Personal commun., 2007.

Southern Cape Cod

On the south shore of Cape Cod, Belding (1910) described a bay scallop harvesting area about 15 miles (25 km) long and 2–3 miles (3.5–5 km) wide running from the shore from Hyannis Harbor to Monomoy Island south of Chatham. The conditions were favorable for scallops: the rise and fall of tide (about 2 ft; 60 cm) was small, water circulation was good, and the sand bottom and water depth were suitable. Most of the fishery was conducted on the open coast, but some is in the bays, such as Stage Harbor, Chatham; Lewis Bay, Hyannis; and Osterville Bay, Barnstable. Off Harwich, the grounds in places extend a distance of 2–3 miles from shore. The intervening bottom is sandy with patches of eelgrass. Some scallops were present. Water depths in the offshore grounds ranged from about 10 to 30 ft (3–9 m) with considerable areas about 15 ft (4.5 m) deep. In Chatham, about 2,000 acres of eelgrass flats sheltered by Monomoy Island furnished excellent grounds for bay scallops (Fig. 70). Little information about the fishery in southern Cape Cod was available for this paper, except for some landings data from individual towns. Chatham continued to be the leading producer.

Buzzards Bay

The grounds where bay scallops were harvested in Buzzards Bay included the various coves and harbors along the shores and on grounds farther from shore including those as far as the middle of the bay (Fig. 64). Its bay scallop fishery began in New Bedford in 1870 (Belding, 1910). From 1870–79, it furnished a winter living for about 15 men. From New Bedford, the fishery spread rapidly to the other bay towns. Shanties and fish houses for opening scallops and storing gear for quahogging and finfishing were constructed along the waterfronts in every town; some towns had at least 20 shanties (Anonymous, 1893b). Official health permits were not required in the early years to open scallops in the shanties or at fishermen's houses. Openers used knives with wooden handles, and the "eyes" were put into various types



Figure 78.—Christmas wreath decorated with bay scallop shells, Nantucket, Mass., 2006.

of bowls and second-hand cans that had been washed with clean fresh water. The scallop meats were taken the same night or early the next morning to fish markets (wholesalers) for shipment to markets (Sayles¹²). Shipments to New York City were troublesome on warm days if ice was unavailable. In February 1885, for example, a scallop shipment to New York spoiled enroute (Anonymous, 1885a).

Ryder (1934) described the following bay scalloping scene in Marion on Buzzards Bay, in about 1887: "The men are out dragging, hoping to bring \$50,000 into the village during the next few weeks. The boats come in full, night after night, sometimes 80 bushels to a boat as the catch was not limited. The great heaps of the brown shellfish are piled almost filling the small craft. The men in rubber hip boots on the wharf

shovel the day's haul into great baskets to hurry into the little shanties where the boys of the village wait to cut deftly from the dark mass, with a quick turn of the knife, the white "eye." After the boats were unloaded, the task remained of cleaning the boats so all may be ready for a start at daybreak next morning. With bucket and broom they clean the deck and sides of the cockpit, corralling every starfish, the deadly enemy of the scallop, peer at the mast and boom, scan the nets of the dredges, for most of these scallop fishermen of the villages are deep sea sailors all with a sense of making everything "ship shape."

Buzzards Bay scallops were scarce for about 7 years between 1900 and 1909. Fishermen attributed the scarcity to predation by large numbers of starfish which they had witnessed (Anonymous, 1909).

The demand for bay scallops grew steadily, more men sought them, and the fishery expanded. Sailing catboats were the most common boat used for harvesting them. In 1915, there may have been only one train/day going westward alongside the Buzzards Bay south shore to New York City, because a 1915 newspaper (Anonymous, 1915e) reported that some boats were on the scallop grounds around midnight, fished

by moonlight and returned soon after daybreak with their limits of 10 bu/man, striving to get their scallops opened in time for the morning train. About 100 boats with nearly 200 men were out harvesting scallops.

Nantucket

Scalloping began on Nantucket in 1883 (Belding, 1910). The bay scalloping grounds are in 1) Nantucket Harbor,

about 6 miles (9.6 km) long and from 0.5 to 1.7 miles (0.8–2.75 km) wide; 2) Madaket Bay, 2 miles (3.25 km) across; and 3) the shoals that lie just off the north side of Tuckernuck Island (Fig. 75). Scallops sometimes are found in Nantucket Sound just off the north shore of Nantucket Harbor (Reinemo¹¹). Among these areas, Nantucket Harbor produces, by far, the most scallops (Fig. 79, 80). The water depths of the Nantucket scalloping areas range from 2 to 8 ft (0.6–2.4 m). The larvae that have stocked the Tuckernuck shoals may come from adult scallops that were in Madaket Bay (Conant¹).

Bay scallops initially were harvested on shallow flats where eelgrass grew in Nantucket Harbor. Most of those taken were seed and too small for human consumption, so they were sold for bait to finfishermen who wound the rims of drained and dried scallop guts around their hooks (Coffin²⁴). In 1878, men with about 9 teams of horses and wagons were going out on the harbor flats raking scallops. Any scallops big enough to eat were taken in the wagons or in rowboats to fishing shanties to be opened. The larger scallops were present in the deeper waters and were harvested from dories. Two men were in each and both rowed, and they towed two scallop dredges. The dredge bags were made entirely of twine mesh, which required much mending (Andrews, 1990).

Nantucket bay scalloping began on a larger scale using catboats under sail in the late fall of 1879 (Fig. 14). Scallops were opened in shanties and shipped to New York City commission dealers, and eventually about 20 scallop opening houses stood around the edge of Nantucket Harbor until the 1940's. Farmers took the shells, crushed them, and spread them on their fields (Reinemo¹¹; Sayles¹²). Several of the buildings used as scallop shanties remain but are now small shops selling tourist items (Fig. 81). The shipping containers were butter tubs made of dovetailed quarter-inch pine boards, and were tight and clean. When harvest restrictions were first im-

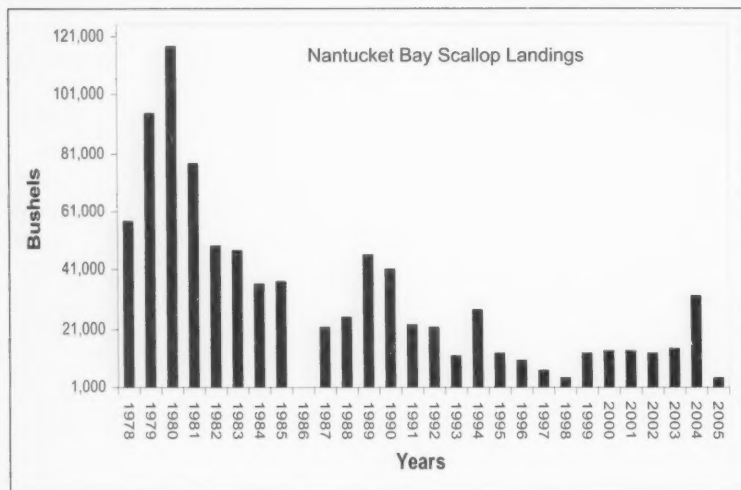


Figure 79.—The landings of bay scallops on Nantucket, Mass., declined after the late 1970's and early 1980's. Source of data: The Nantucket Shellfish Department.



Figure 80.—Nantucket shellfish officer chats about the scalloping season with husband and wife scallopers after they landed their harvest, 2006.

²⁴Coffin, E. W. Shellfisherman, Nantucket, Mass., Personal commun., 2006.

posed in 1901, local authorities allowed fishermen to harvest some scallops after the season closed on March 31st until May 15th, to be sold for \$0.25/bu cash to trawler fishermen to use as bait (Andrews, 1990).

In recent decades, the Nantucket bay scalloping fleet has varied in size, following the trend in scallop abundances. In the early 1980's, from 120 to 150 dredging boats began each season; in 2004, the fleet size was about 25 boats, besides 4 or 5 scuba divers (Fig. 82), in Nantucket Harbor, and 5 boats in Madaket Bay (Fig. 83) (Anonymous, 2006). At least half of the boats have a crew of two, the second often being a fisherman's wife or a teenager. To make the fishery more fair for the regular scallop fishermen, Nantucket has reduced the numbers of part-time bay scallopers by ruling that fishermen who want to harvest scallops must purchase their license in March, or 6 months ahead of the season opening, and by raising the license fee to \$250 (Coffin²⁴).

Nantucket openers of bay scallops currently are paid at the rate of 20% of the price that buyers pay fishermen for the meats. This may be as much as \$2.40/lb (\$21.60/gal) if the fishermen receive \$12/lb for the meats. The scallop opening houses (currently 3 are active) pack the meats in plastic bags, refrigerate them, ship them the next day by refrigerated truck on the ferry



Figure 81.—On Nantucket, former bay scallop opening shanties are now shops selling tourist items, 2006.

to Hyannis, Mass. From there, they go to distant markets, mostly to New York City and fewer to Greater Boston, Mass., and Providence, R.I. Buyers there sell directly to fish markets and restaurants with wholesaler's licenses (Sayles¹²).

Martha's Vineyard

Bay scalloping began on Martha's Vineyard in 1875 (Belding, 1910). The principal scalloping areas on island are (from west to east) Menemsha Pond, 1.5 miles (2.4 km) long and 1 mile (1.6 km) wide; Lagoon Pond, 2.2 miles

(3.5 km) long and 0.5 miles (0.8 km) wide; Sengecontacket Pond, 2.2 miles (3.5 km) long and 0.3 miles (0.5 km) wide; Katama Bay, 2 miles (3.25 km) long and 1.5 miles (2.4 km) wide; Edgartown Harbor, up to 3 miles (5 km) long; and Cape Poge Pond, 2.5 miles (4.0 km) long and 1.1 miles (1.6 km) wide (Fig. 84). The scalloping areas are controlled by 5 towns, each with their own designated waters; as noted, some water bodies are shared between two towns, e.g. Menemsha Pond between Aquinnah and Chilmark, Lagoon Pond



Figure 82.—This Nantucket fisherman harvests scallops commercially using scuba gear. In December, 2007, he was gathering one bushel of the scallops while using each of his four air tanks.



Figure 83.—Unloading his harvest of bay scallops onto his truck at the shore of Madaket Bay, Nantucket, Mass., 2006. This fisherman has been harvesting bay scallops for 51 years.

between Tisbury and Oak Bluffs, and Sengecontacket Pond between Oak Bluffs and Edgartown.

During the 1990's and 2000's, the quantities of scallops have declined and fewer jobs for scallop fishermen and openers have been available on Martha's Vineyard and Nantucket. The permanent residents have not felt much of an economic pinch, because alternate jobs have become available, especially in the building and tourist trades, for people who might have been engaged in scalloping. Yet scalloping, commercial and recreational, continues on both islands, and nearly all the available scallops are harvested each year.

Figure 84.—(right) The locations of most of the scalloping areas on Martha's Vineyard, Mass.

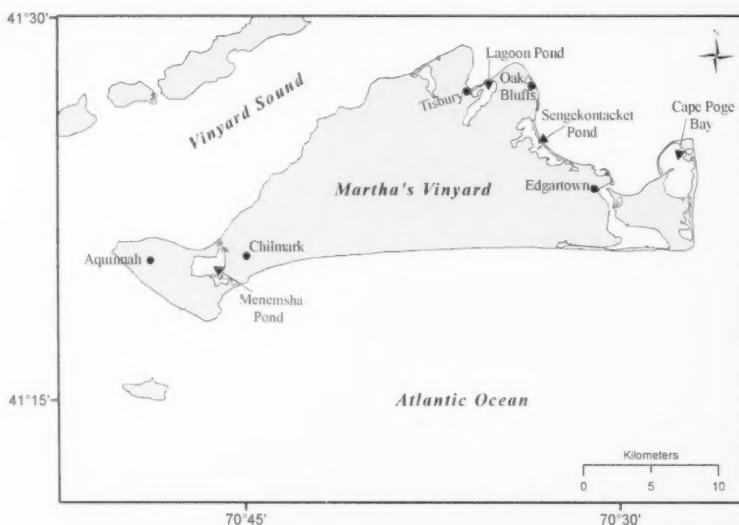
Figure 85.—(below left) Edgartown produced most of the scallops on Martha's Vineyard. This fisherman is emptying his dredge of bay scallops and 'shack' in Cape Poge Pond, 2006.

Figure 86.—(below right) Edgartown fisherman opening his harvest of bay scallops in the basement of his house, 2006.

From 1980 to 2005, Edgartown (Fig. 85, 86) landed 73% of the island's bay scallops, an average of 13,060 bu/yr as compared with 3,840 bu/yr for the remaining island towns. In 2005, the landings (in bushels) in various towns were: Edgartown, 6,014; Oak Bluffs, 1,674; Vineyard Haven, 2,926; Chilmark, 640, and Aquinnah, 438, for a total of 11,692 (source, various annual town reports).

Recreational Harvesting

Recreational or family harvesting of bay scallops has been a tradition in Massachusetts every fall. It is an enjoyable pastime, with the prize being several meals of delicious bay scallops. All state residents in Massachusetts can obtain a license to harvest bay scallops legally in any bay in the state for their own use during an open season; they cannot sell



them. In 1889, the state residents could take as many as 3 bushels of scallops/day for family use (Anonymous, 1889), but this quantity has since been reduced to one bu/week. For family use, the scallops have been obtained by people wading in the shallows of bays. They use pushers, look-boxes, and scoop nets (Beal²⁵).

Wearing waders or wetsuits, the fishermen wade in waters as deep as their chests. Their gear is a look-box, a scoop net, and a wire basket placed in a rubber tube that is towed with a string around their waist. They wade through shallow eelgrass meadows peering down at the bottom and finding scallops among the eelgrass blades and also in clear openings several feet wide. A sunny day is best for spotting them, but some scallops are felt beneath the fishermen's feet. They often remain out for as long as 3 hours trying to obtain the limit. The scallops are opened at home and divided into meal-sized portions, some to be eaten immediately but most are placed in plastic bags and chilled or frozen for later use (Beal²⁵). Recreational scallop landings total about 1% of Martha's Vineyard's commercial landings (Town annual reports).

In recent years, recreational scalloping can begin on October 1st, a month

ahead of the commercial season, and is allowed until the end of the commercial season, March 1st (Fig. 87, 88), but, in effect, the fishery usually lasts only through October because afterward the water becomes too cold for wading (Beal²⁵). Harvesters are required to purchase a license. In the 2000's, the license fee in Edgartown costs \$50 for a town resident, and \$220 for a nonresident (Searle²⁶; Bagnall²⁷). The license is free for everyone at least 60 years old (Bagnall²⁷). In recent years, about 100 recreational fishermen in Nantucket are harvesting on an October weekend: 90% use pushers; no dredging is allowed (Sayles¹²).

Rhode Island

Rhode Island bay scallop landings were first recorded in 1880: 30,000 bushels were tallied (Fig. 89), but the fishery had begun before that. Between 1880 and 1959, the landings over time ranged widely among years, from 300 bushels (1905) to 71,000 bushels (1945) (about 21,000 bu/yr, avg.) (Lyles, 1969). After 1959, the landings have been almost nonexistent, except for 1978, 75,000 bushels; 1979, 23,000 bushels; 1983, 7,400 bushels; and 1984, 4,400

bushels (NMFS landings statistics). The fishery ended in 1985, when a brown tide killed the scallops and also blue mussels. The scallops have since been too scarce to support harvests.

In November, 1877, an anonymous newspaper reporter visited the small village of Scalloptown (on the southwestern shore of Greenwich Bay) (Fig. 90), and wrote the following notes about the bay scallop fishery:

"The scallops were harvested with catboats, about 20 ft (6 m) long. Each towed 4-6 dredges which cost \$5 each. The scallopers wore oilskins and used oilskin bibs (Fig. 91). When not in use, the catboats were tied to stakes at least 100 ft (30 m) away from piers and docks. The fishermen got to them in their rowboats, which they tied to the stakes for the day when they got aboard their catboats."

"The scallop packing house had a wooden counter along its entire length on one side. The "cutters,"



Figure 88.—The recreational scallopers in Nantucket gather their bay scallops using push rakes. Source: Book entitled, *Scallop Season A Nantucket Chronicle*. Autopsot Press. Publication date, 2002. Photograph used with permission of Robert Benchley, III.



Figure 87.—Recreational scalloping is popular on Nantucket, Mass. every October. The fishermen hold the bushel of scallops they are allowed each day in baskets supported at the water surface by rubber tubes. Photograph courtesy of Nantucket Historical Society.

²⁵Beal, K. Fishery Biologist (ret.), NMFS, NOAA, Gloucester, Mass., Personal commun., 2006.

²⁶Searle, D. Shellfish officer and shellfishermen, Vineyard Haven, Mass., Personal commun., 2006.

²⁷Bagnall, P. Shellfish officer, Edgartown, Mass., Personal commun., 2006.

most of whom were girls and some were men, began opening the scallops as soon as they were landed (Fig. 92). They discussed the quantity of scallops brought in and they calculated the number of quarts they might open. They were paid \$0.15/gal. The scallop meats were washed and drained, and then boxed or barreled and sent to market. The markets paid the packing houses \$0.65/gal for the meats."

In the late 1800's and first two or three decades of the 1900's, the most important bay scallop-producing areas

in Rhode Island were Greenwich and Cowesett Bays in the northwestern part of Narragansett Bay; and some scallops were caught in Mt. Hope Bay in its northeastern part. In 1879, about 90 sailing boats, most of which were catboats but also 2–3 sloops and a few sharpies, comprised the scalloping fleet. The large boats towed 6–8 dredges at a time; the smaller ones, 3–5. The fish houses furnished some of the boats, dredges, and other gear to the fishermen (Anonymous, 1877, 1916d; Ingersoll, 1887).

About 100 people, 25–30 of whom were women and girls, opened the scallops. Opening was rarely done on the boats, since it was believed that the

discarded scallop "guts" fouled the beds. Some of the shells were sold to Rhode Island oyster growers who used them as cultch for setting oyster larvae. The bulk of the scallops were sold in New York City, the remainder went to Providence and Newport, and towns in Connecticut. Much of the scallop catch in 1878 had to be discarded, due to a lack of markets (Ingersoll, 1887).

In 1914, Rhode Island issued 24 bay scallop licenses, and, in 1915, 65 such licenses that cost \$15 each and were good for 4 months, September through December (Anonymous, 1915d). In 1920, 100 scallop licenses were issued. That year, the state reduced the daily limit of scallops/license from 25 to 15 bushels (Anonymous, 1920). But by then, the scallops had become scarce in Greenwich, Cowesett, and Mt. Hope Bays. Most scallops afterward were harvested in the southern areas of the state, particularly in Pt. Judith Pond, which exchanges its waters with those in Block Island Sound through an opening at its south end.

By the 1920's and 1930's, a typical bay scallop boat was a converted catboat, about 23 ft (7 m) long, usually driven by a small gasoline engine and propeller. It towed 6–8 dredges, each limited to a width of 30 in (75 cm) by state law. By the 1940's, the boats had second-hand automobile engines (Manchester²⁸). By the 1950's, scallop fishermen were using wooden rowboats, 14–16 ft (4.25–4.9 m) long, with outboard motors. This made it easy for nearly every fisherman and tradesman who owned or could borrow a rowboat to go scalloping; one or two men were in each boat. In addition, small numbers of men "dip-netted" for scallops from rowboats and a few used scuba gear to get them. In the best years, about 600 boats comprised the Rhode Island Bay scalloping fleet (MacKenzie, 1997; Dykstra²⁹; Ganz³⁰). During the



Figure 89.—The former bay scalloping areas in the Narragansett Bay area, R. I.

²⁸Manchester, F. Shellfish dealer (ret.), Manchester Sea Foods, Tiverton, R.I. Personal commun., 1992.

²⁹Dykstra, J. Shellfisherman, Kingston, R.I. Personal commun., 1991.

³⁰Ganz, A. Department of Environmental Management, Division of Fish and Wildlife, (ret.). Personal commun., 2006.



Figure 90.—Scallop town on the shore of Greenwich Bay, R. I., 1930's. Photograph courtesy of Rhode Island Historical Society, Providence.



Figure 91.—Scene aboard a scallop boat in Greenwich Bay, Rhode Island, 1877. The fishermen are wearing oilskin pants made of muslin cloth soaked in linseed oil to repel water. Source of illustration: Frank Leslie's Illustrated Newspaper.

lean years of the 1970's and 1980's, the main scalloping area was Pt. Judith Pond (Ganz³⁰).

From the 1950's onward, some fishermen set up benches on various shores to open bay scallops, some others opened them on their boats after they docked, while most opened them at their homes or in fish markets. The openers put the scallop meats into most any type of large can, including those that once held salted hams, but eventually everyone used stainless steel cans. The state ruled that the opening had to be done in shops that were sanitary and were approved and licensed. Some fishermen took their whole scallops to fish markets to have them opened by others. Buyers paid the fishermen for the meats after taking out the opening costs (Manchester²⁸; Dykstra²⁹).

Importance of the Fishery

After the 1950's, the relatively small scallop fishery in Rhode Island could be considered as a "frosting-on-the-cake" fishery in the seashore economy. It had



Figure 92.—Opening bay scallops in a large shanty, Scallop town, R.I., 1877. Illustration from Frank Leslie's Illustrated Newspaper, courtesy of Rhode Island Historical Society, Providence.

the status as a "fun" occupation that brought in some extra money when scallops were abundant in widely scattered years. No one would have gone without the bare necessities of life had there been no scallop fishery (Ganz³⁰).

Connecticut

Little has been written about the bay scallop fishery in Connecticut. In 1911

the *Fishing Gazette* mentioned that a scallop fishery was active in shallow beds between the waters of Rowayton and Norwalk, communities that are about 6 miles (10 km) apart (Fig. 93). No details were provided. Coastal islands protect those shallows during southerly wind storms. Bay scallop shells can now be found in their sediments (Hopp³).

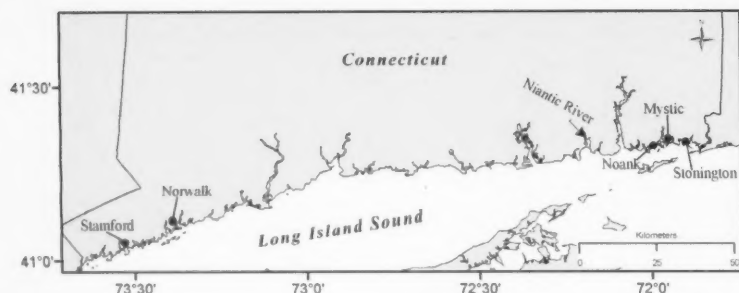


Figure 93.—In Connecticut, bay scallops were harvested between Stamford and Norwalk and from the Niantic River through Stonington.

Bay scallops were also harvested in eastern Connecticut from the Niantic River eastward along the coastal zone to and including Stonington, about 18–21 miles (29–34 km) to the east. The shallows that scallops inhabited are similarly protected by islands lying off the main coastline. The fishery was active in the Niantic River and in the towns of Noank, Mystic, and Stonington.

Connecticut bay scallop landings were recorded from the late 1800's to the early 1960's. The annual landings were relatively small and spotty until the early 1930's. From 1933 to 1949, the landings averaged about 8,300 bu/yr; the biggest year was 1935, when 48,000 bushels were landed. The largest landings were from 1950 to 1962, when they ranged from 11,000 to 70,000 bu/yr; 25,000 bu/yr, avg.), but afterward the landings declined (Lyles, 1969).

Niantic River

Annual bay scallop production in the Niantic River has fluctuated with changes in eelgrass abundance. The river is a confined area with a narrow opening, about 135 ft (40 m) wide between Niantic Bay and eastern Long Island Sound. Scallops were scarce when the eelgrass was abundant, and vice versa; or the opposite effect of the eelgrass presence in other locations. When eelgrass was abundant in the river, it grew too thickly for scallops and usually inhibited them from attaining commercial densities. After the eelgrass died in the 1930's, scallops were frequently abundant. Where the scallops were present in the

river, the scallop zone was mostly 7–8 ft (2.1–2.4 m) deep, about half a mile (800 m) wide, and 4 miles (6.4 km) long. By local decree, people could gather scallops only by dip netting with a limit of 1 bu/man/day. From 1976 to 1987, whenever scallops were generally abundant, about 10–15 fishermen, all using look-boxes and dip nets from small boats, harvested scallops during the week. As many as 50 fishermen harvested on weekends (Daboll³¹). Niantic River scallops currently are scarce.

Stonington Area

In the Stonington area, the bay scallops inhabited protected coves off Fishers Island Sound, where depths were 6–8 ft (1.8–2.4 m). In the 1940's and 1950's, about 25 boats comprised its bay scallop dredging fleet. This fleet was a little larger than those in Mystic and Noank. The boats were rowboats with outboard motors and also 20 ft (6 m) boats with inboard engines taken from old or wrecked automobiles. Some scallops were harvested by fishermen in rowboats using look-boxes and scoop nets. Catches were unlimited in the late 1940's, and each motor boat harvested from 30 to 50 bu/day whenever the scallops were abundant (Madeiros³²).

Bay scallops were opened in a building on the dock by 10–15 people, some of whom were school children

who opened in afternoons after school and on weekends. Some scallops were sold in the shell to a trucker who drove them to Norwalk, Conn., to be opened and sold. It was more profitable for the fishermen to get more scallops to sell in the shell than it was to harvest fewer hours and then spend time opening those they had harvested themselves. Empty shells in barrels were taken by the scallop boats and dumped in the water outside the harbor. Scalloping ended in the Stonington vicinity, when environmentalists stopped them from dredging scallops to protect the eelgrass meadows (Madeiros³²).

Long Island, N.Y.

The annual bay scallop landings in Long Island, N.Y., were the second largest after Massachusetts among the states (Fig. 94), and, as in the other states, scallop abundances varied widely among years. Landings data are available for 3 early years: In 1891, 69,565 bushels worth \$48,340 were landed; in 1898, the landings were 103,063 bushels worth \$49,960; and in 1903, they were 169,294 bushels worth \$100,607 (Anonymous, 1903a). In 1900, scallops were shipped daily from eastern Long Island to New York City by rail, an average of about 500 gallons from the train depots between Greenport and Jamesport (Anonymous, 1900). Scallops were landed every year thereafter through 1984. From 1938 to the late 1940's, when eelgrass was nearly absent, the lowest landings, an average of 8,800 bushels (range, 3,500–17,800 bushels), were tallied. From 1950 to 1985, during which the eelgrass beds again covered large areas of the scalloping grounds, the average scallop landings were 62,400 bushels (range, 15,500–141,000 bu)/yr. Since the 1985 brown tide episode, the landings have been low, an average of 3,500 bu/yr, but included in this figure is the unusually high landing of 45,200 bushels in 1994; the average without that year is 1,250 bu/yr (Lyles, 1969; NMFS landings statistics). Another brown tide in 1995 killed nearly all the scallops that could have provided a spawning stock for the next generation.

³¹Daboll, R. River Commission, Niantic, Conn., Personal commun., 1992.

³²Madeiros, A. Shellfisherman, Stonington, Conn., Personal commun., 2006.

The Scalping Bays

In the early 1900's, most of Long Island's bay scallops were harvested in Peconic and Gardiners Bays, the remainder in several other bays on Long Island. The others included Oyster Bay Harbor (Flower³³), Lloyds Harbor, Huntington Bay, Northport Harbor, Great South Bay, Mecox Bay, and Shinnecock Bay (Berglin³⁴). Scallops were harvested in Oyster Bay Harbor until the eelgrass die-off in the 1930's, but none have been present since then (Flower³³; White³⁵). Scallops are still harvested in some years on the grounds where eelgrass meadows grow on the bay side between Jones Inlet and Fire Island Inlet at the west end of Great South Bay.

The principal bay scalloping grounds are in Little Peconic, Great Peconic, and Gardiners Bays. The expanse of water across this area is about 25 miles (40 km) long and is of varying widths from narrow zones up to 5 miles (Wood, 1907). The three main scalloping areas were 1) Orient-East Marion, 2) Northwest Harbor (Sag Harbor), and 3) Great Peconic Bay and Flanders Bay (Calf Pasture). Scallops inhabited broad bottoms of hard sand, where depths were 4–12 ft (1.2–3.7 m), and in the bay some scallops were also in the drenes (shallow channels) on shallow sand bars, and some were in waters as deep as 25 ft (7.5 m). The tidal range is about 4 ft (1.2 m). The scallop distribution was fairly widespread in the years of good sets and survival of the seed. Scallops were also present in 5–8 ponds, that were 5–10 ft (1.5–3 m) deep, and creeks that bordered the south side of Peconic Bay. The state designated separate town and state waters. Eventually, only town residents could harvest scallops in the waters of their town, but all state residents could harvest in all state waters (Wenczel³¹; Morris³⁶).

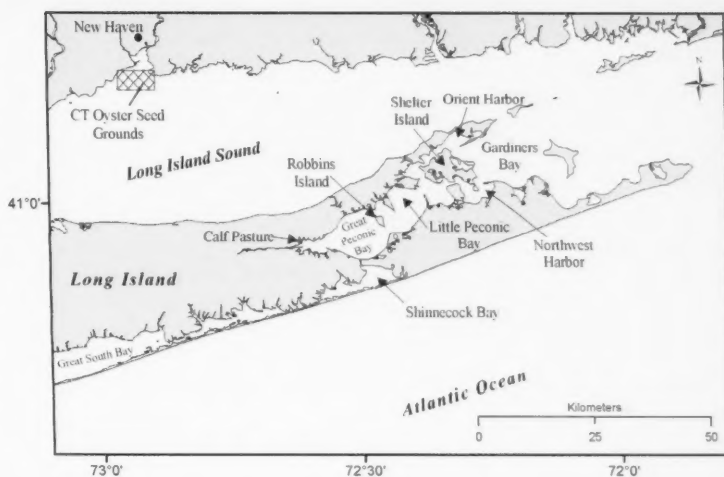


Figure 94.—In New York, most bay scallops were harvested in the bays of eastern Long Island.

The First Years

Ingersoll (1887) and a Southold, N.Y., newspaper (Anonymous, 1917b) described what may have been the beginning of commercial bay scalloping in Peconic Bay. In 1857, local residents observed a boat from Connecticut harvesting scallops on grounds just northeast of Robbins Island. The next year, the same boat returned to harvest scallops because a demand for scallops had developed in Norwalk, Bridgeport, New Haven, and other Connecticut towns. This time, a citizen in New Suffolk tried shipping to New York City some scallops that he and friends had harvested. He sent 7 gallons of whole scallops in a common nail keg. Fulton Market replied that no one knew what they were, but if he would send some meats they might sell. Accordingly, some were shipped in a box to the city and in a week \$3.00 was returned as proceeds from this sale. From then on, some residents in New Suffolk were harvesting and selling scallop meats every year and this tiny community became the bay scalloping center on Long Island. The shucking shanties used to save the guts from the scallops and mix it into compost with seaweed from the beach to make a rich fertilizer for growing corn.

Mather (1896) said that the people of New Suffolk were supported mainly by bay scallops from early September to the first of May. Twenty-six sloops, each operated by two men, one at the tiller and the other at the culling board, along with a few smaller boats harvested the scallops (Fig. 95). About 70 men operated the boats. While dredging for scallops, the crews kept the whelks and starfish to be given to local farms for use as fertilizer. About 30 women, 20 men, and as many as 80 children, who stopped on the way home from school, opened the scallops (Fig. 96). They were paid \$0.16/gal for opening large scallops and \$0.25/gal for small ones. Shippers received \$0.65/gal, and the shells were sold to Connecticut oyster planters for \$0.06/bu.

Ingersoll (1887) reported: "The beach at New Suffolk is lined with their (scallop) houses, no less than eleven of them of which are seen within a quarter of a mile's walk along the sands. The largest of these buildings is 30 ft (9 m) long by 20 (6 m) wide. A broad shelf runs along each side, projecting a couple of feet from the walls, and reaching to the waist of a man. Holes are cut in this shelf at regular intervals along its length. Barrels are placed under these holes for the refuse. The scallops are

³³Flower, F. Shellfish dealer, Oyster Bay, N.Y., Personal commun., 2006.

³⁴Berglin, J. Shellfisherman, Long Island, N.Y., Personal commun., 2006.

³⁵White, G. Shellfisherman (ret.), Stratford, Conn., Personal commun., 2005.

³⁶Morris, J. Shellfish dealer, Quogue, Long Island, N.Y., Personal commun., 2006.

piled up at the back of the shelf spoken of. The openers are generally women, of all ages. Apart from the damp floors and dripping surroundings the work is not hard. Some of the young girls work after being married; come regularly in the season to gain a penny or two for those little extras coveted by all."

Wood (1907) described some additional details about the first years of the Peconic Bay scallop fishery. The fishermen prepared their boats and dredges for scalloping in August, as scouts dredged over the beds to determine where they would find scallops once the season began. About 200 sailing vessels (presumably sloops, catboats, and sharpies), each carrying three men, were engaged in the scallop fishery. During the begin-

ning weeks of a season, the average catch for each boat was about 35 bu/day, but a large percentage was seed scallops. The scallops sold for \$1.50–\$3.00/gal. Each boat crew earned about \$600 for the 1904 season. The scallops had to be brought to shore and opened in time to be shipped on the night train to New York City, because unless shipped at once the scallops could spoil because there was no refrigeration. In the coldest weather, fishermen at times kept scallops frozen in snow banks awaiting a rising market. The total earnings for all the fishermen were \$200,000.

In the late 1800's and early 1900's, the state did not impose daily catch limits, and the fishermen caught all the scallops they could in a day, with the best cap-

tain taking the most. At the end of a day, the boats sailed to the shores where the scallops were to be opened. The shanties were located just below the tops of the dunes on their inland sides. Crews anchored their boats close to shore and shoveled the scallops into rowboats to get them ashore. Once there, they shoveled them into wheelbarrows and then pushed them to the shanties over planks laid on soft beach sand (Berglin³⁴).

Bay scalloping became an important part of the lives of at least a thousand people on Long Island, from a little before 1900 to 1985. Full-time and part-time fishermen harvested them; men, women, and older children opened them; and wholesalers packed and sent them to markets. Most of the active fishermen in the early weeks of good seasons were part-timers: Tradesmen taking leave from their regular jobs and potato farmers. During the 1920's, the scallop fishery in Peconic Bay also provided employment for many former oystermen when the oyster fishery was slumping due to the typhoid scares (Anonymous, 1923; MacKenzie, 1996).

Limiting Daily Harvests

In the early 1900's, New York State eventually clamped limits on daily bay scallop harvests by each fisherman and each boat (Table 5). Scallop fishermen



Figure 95.—Dredging for bay scallops in a light wind, Peconic Bay, N.Y., 1915. Shown are a catboat (left), sharpie (center), and three sloops (right). Source of photograph: Lightfoot et al., 1984.



Figure 96.—Waterfront in New Suffolk, N.Y., 1914. Most of the buildings are scallop shanties. Source of photograph: Lightfoot et al., 1984.

Table 5.—New York laws pertaining to the harvests of bay scallops.

1. Separate state and town waters are designated. All fishermen can harvest bay scallops in designated state waters, but only residents of their towns can harvest them in their town waters.
2. Dredges will have a maximum width of 36 in.
3. Scallop dredges have to be retrieved by hand. Hauling by power was not allowed as it is in Massachusetts.
4. The daily limit of scallops was 10 bu/man (the official bushel was 4 pecks); 20 bu/boat with 2 licensed individuals.
5. The minimum width of a scallop that can be taken has been 2.25 in (5.8 cm). New York State has a size law for bay scallops and they must have an annual ring. This requirement for 2.25 in and an annual ring is new. In the past, scallops had to be 2.25 in wide or have an annual ring. By mid-November, a large portion of the seed had grown to legal size.
6. The state used to open the season on the first Monday in September, but the date was moved down to the third Monday in September. The scallop season ends on March 31st. The opening of the bay scallop season has been delayed even further from the first Monday in October to the current opening date of the first Monday in November.
7. No dredging on Sundays; only picking-up is allowed.
8. Only sail could be used to propel boats for scallop dredging until about 1950.

with large boats were incensed at this law, because baymen with a \$15 sharpie could harvest as many scallops as those with a \$500 sloop or catboat. They believed that the people who were making from \$2 to \$4 an afternoon opening scallops would be deprived of that employment, because when fewer scallops are taken two men in a boat could do their own opening. The law benefited the scallopers, though, because the limited catch translated into a higher price for scallops, yielding better returns from less labor (Anonymous, 1906).

Selling "Bugs" (Seed)

The *Fishing Gazette* published several articles about the Long Island fishermen harvesting "bugs" (seed bay scallops) for sale; the largest bugs had "eyes" nearly the size of the adult scallops, and they were acceptable in markets (Fig. 97). Late fall, at least in the years when bugs were abundant, often was termed the "bugging season." If any scallops were large enough to open, most fishermen retained them. Most did not believe that taking bugs reduced the scallops' availability the following year, because there were so many (Bourguignon¹⁵; Berglin³⁴) but state officials and some fishermen were opposed to taking them (Anonymous, 1919b). To avoid the law, several fishermen went for bugs at night in various years. In the early 1900's, some irresponsible fishermen were harvesting legal scallops and bugs in 20–50 bushel lots (Bourguignon¹⁵), and after opening the largest scallops, they dumped the remainder onto the shell heaps, thus causing a great waste (Anonymous, 1905).

In 1915, the *Fishing Gazette* (Anonymous, 1915a, b) reported that some baymen were violating the law by taking bugs, but they believed they had to do it or have their families go hungry. They wanted to scallop legally, but said they were forced to violate the law, as they had no other work. A former scallop buyer talking about the 1960's, 1970's, and 1980's related that many fishermen caught bugs and did well financially. The state did not bother with the growth line, but the scallops had to be at least 2 in (5 cm) wide. After a while, the fisher-



Figure 97.—Collection of bay scallops dredged in Cape Poge Pond, Martha's Vineyard, Mass. in 2006. Shown are adults and large seed. In Peconic Bay, Long Island, N.Y., some fishermen once illegally retained such seed (they were termed "bugs" by local New York fishermen), opened them, and sold their meats.

men grew tired of measuring and kept the scallops that were nearly legal size (Bourguignon¹⁵).

Conflicts with Oystermen

Since at least 1900, some Peconic Bay grounds near Robbins Island and in Sag Harbor were held under grants by oyster companies to grow the seed that had set on their Connecticut beds. The companies employed watch boats to keep the scallopers off their grounds. In 1914, an oyster company petitioned the State Shellfish Commissioners to lease 600 acres of grounds off Shelter Island, Peconic Bay, to grow oysters. The petition was denied after the local bay scallop fishermen protested that the grounds were used for harvesting scallops (Anonymous, 1914).

The 1940's to 1985

As noted, scalloping became good again, though annually variable, begin-

ning in the early 1950's. The commercial scalloping season typically opened in state waters 2–3 weeks before town waters were opened. At the beginning of seasons, the fishermen harvested only in state waters, leaving the town waters alone temporarily. In the 1970's and 1980's, during the first few weeks of seasons in which the scallops were abundant, from 300 to 400 boats, mostly driven by outboard motors (Fig. 98) were harvesting scallops: about 100 in Northwest Harbor, 100 in Orient, and 100 in Flanders Bay (Calf Pasture) at the far western end, and some in other parts of the Peconic Bay system. About one-fourth of the 400–500 fishermen were full-time fishermen, while the remainder consisted of part-timers. Harvests were best for about a month, and nearly every fisherman got a full limit. When 2 men were in a boat, 20 bushels could be harvested in 3–4 hours. In succeeding weeks, harvests of 5 bu/person/day were

closer to the norm. In many years, ice covered the beds for about a month and harvesting was impossible (Bourguignon¹⁵; Wenczel²¹; Berglin³⁴).

During the 1970's and until 1984, New York's scallop landings averaged about 54,000 bu/yr, but there were the usual annual wide fluctuations in bay scallop availability. A few fish markets and also individual fishermen sold their scallops to local restaurants. One buyer froze scallops in gallon cans and sold them to restaurants in the summer (Morris³⁶).

Gear and Use

Before the 1950's, a state ruling stipulated that any boats dredging for bay scallops had to use sails for propulsion or else be rowed or pulled by hand (anchor roading). Motor boats could not be used. In addition, the state consistently has ruled that the dredges had to be retrieved by hand-hauling, even today. During the 1940's, some fishermen began using outboard motors to harvest more efficiently. They rigged up a phony square sail and put a burlap bag over the motor to hide the exhaust fumes and fool the conservation officers on shore into believing they were using only sail power (Berglin³⁴).

When the bay scallops became abundant again during the 1950's, the state changed its ruling on motors and allowed the scallopers to use them to run their boats. Since then, most of the scallop boats have been wood or fiberglass outboard motor boats about 15–20 ft (4.6–6 m) long, though some used 33–36 ft (10–11 m) lobster-style boats. Most small boats towed 4 dredges, but some could tow 6–8 dredges with and without outriggers. Some men brought their wives along to cull so they could obtain

a double limit: 20 four-peck bushels of scallops (Wenczel²¹; Berglin³⁴).

Some local potato farmers harvested bay scallops by anchor roading. The farmers purchased second-hand rowboats, dredges, ropes, and anchors. They had their employees, i.e. workers who lived on their farms, harvest and open the scallops. The farmers sold the scallops meats and paid the men their usual weekly wages (Berglin³⁴).

In the creeks, some fishermen picked up bay scallops while wading in waters 1.3–2.3 ft (0.4–0.7 m) deep when tides were low. It was legal to wade for scallops commercially on Sundays but dredging was not allowed; the fishermen attended church on Saturday nights and harvested scallops on Sundays. Wearing waders and holding a look-box, scoop net, and towing a floating basket, they walked slowly through the shallow water, looked at the bottom through the box, and gathered scallops one or two at a time. In the 1970's and early 1980's, 10–12 men did this. Each could get the state limit of 10 bushels in as little as 3 hours at the beginning of good seasons, but after the first month, when the scallops were scarcer, good catches were about 5 bu/day. Several fishermen harvested scallops by snorkeling. They gathered the scallops with their gloved hands (Wenczel²¹; Berglin³⁴).

During the first few weeks in a productive year, the fishermen could return to shore with their 10-bu limit of bay scallops as early as 10 a.m. Some "cheaters" went out twice in a day, usually in an area separate from the first, to get a second 10-bu limit. The fishermen could land their scallops at any location they desired, so it was easy to dodge the three shellfish officers and their two or

three helpers on duty in this large scalloping area.

Opening Scallops

Fishermen opened their bay scallops in numerous shanties distributed in groups along the shores of Peconic and Gardiners bays, and also in large fish houses, or at their homes. In good seasons, the fishermen commonly had some difficulty getting all their scallops opened, because opening 10–20 bags of scallops could be a greater labor chore than harvesting them. At times, fishermen had to take days off from harvesting to catch up with the opening. Many fishermen hired three or four people, including their children and sisters, school teachers, and housewives, to open their scallops (Fig. 99, 100). The fish houses were said to have had "half the high school" opening for them. But at the tail end of the seasons, fishermen opened most of their own scallops (Morris³⁶). In the late 1970's, the openers were earning \$1.00/lb of bay scallop meats, and by the 1990's they were paid \$1.25–\$1.30/lb. Some openers saved the guts of the scallops for sale to tackle shops that resold them to sport fishermen for bait.

Bay scallop shells were piled next to the shanties and at the edges of the fishermen's yards and were eventually spread on beaches, roads, and driveways. Oyster companies took some scallop shells (until at least 1968) to their Connecticut seed grounds as cultch. The scallop shells are excellent cultch because they are clean, oyster spat set on them, and they fragment readily when oyster seed are attached. Some companies brought the Peconic Bay scallop shells that had caught an oyster set in Connecticut back to the bay for the oysters to grow to market size.

Large-Scale Scalloping Ends

The scarcity of scallops after 1985 has created a huge void for the communities in eastern Long Island. The money and the activity that the industry had been generating were gone. Each fall since, weekend day-tourists driving from New York City and western Long Island to eastern Long Island have missed having bay scallops as a treat to bring back

Figure 98.—Fleet of concentrated Peconic Bay, N.Y., boats dredging for bay scallops, late 1970's. Photograph courtesy of Debra Barnes, New York State DEC.



home along with apples, apple cider, potatoes, jellies, jams, wines, and wreaths they used to purchase from roadside stands and wineries.

Displaced bay scallop fishermen have saved their dredges in sheds and cellars (Fig. 101). If the scallops in former abundances were to return, fishermen would be back on the grounds in their former numbers to harvest them (Bourguignon¹⁵).

The State Shell

All U.S. states have adopted important plants or animals to represent them. Pearls are depicted on New York's State seal, arms, and flag, and on 1 August 1988, New York adopted the bay scallop as its official state shell. In signing the bill, Governor Mario M. Cuomo said: "This bill designating the bay scallop as the official New York State shell is intended to recognize the importance of scallops and other marine resources in our state. The designation of the bay scallop as the state shell is largely a symbolic and ceremonial act. Nevertheless, I take it as a clear expression of support for the programs already underway to support the bay scallop fishery in New York."

"The value of New York State's bay scallop harvest ranged from \$488,976 to \$1,840,071 from 1975 to 1984 and averaged 20% of the national production of bay scallops for that period. However, the bay scallop harvest, which is primarily in the Peconic Bay, has steadily decreased since that time. In 1987, New York's harvest was valued at less than \$3,000 and its 373 pounds constituted less than 1% of the national bay scallop production."³⁷

A Scallop Trip On Peconic Bay

On 31 December 2005, I went along on a bay scallop harvesting trip with a fisherman in Peconic Bay, N.Y. The fisherman, about 48 years old, was a fulltime shellfisherman. His principal income came from potting knobbed whelks, *Busyon carica*, during the warm months. He sought bay scallops

³⁷www.geobop.com/NA/US/NY/Shell.htm.



Figure 99.—Opening bay scallops harvested in Peconic Bay, N.Y., late 1970's. Photograph courtesy of Mary Van Deusen.

during the colder months, and, though they have been relatively scarce, he and a few others were making meager earnings scalloping. During the first 10 years of his scalloping, beginning in about 1975, he usually was able to harvest all winter to the end of March. During the last month of those seasons, only a handful of fishermen were still going, and each took 3–4 bu/day. He lived in Greenport but docked his boat in a creek 15 miles (24 km) to the west.

No one was in the creek when I arrived, but at least 20 sport boats were moored at the piers and secured for the winter with canvas and plastic sheets wrapped over their decks and cockpits. The fisherman's boat was 25 ft (7.6 m) long and 8.5 ft (2.6 m) wide. He had purchased the boat in Southampton, eastern Long Island, but only as a hull. He added a small cabin, installed a 175-hp diesel engine, and coated the hull with fiberglass. He used shore ranges to locate the scallop beds and a GPS system to locate specific dredging locations. His boat had 12 dredges, 6 along each of its rails, and they were towed in a line, one directly behind the other unless the boat towed them in a circle. The first dredge



Figure 100.—Women opening bay scallops harvested in Peconic Bay, N.Y., late 1970's. Note the plastic bowls used to hold the scallop muscles. Photograph courtesy of Debra Barnes, New York State DEC.



Figure 101.—Bay scallop dredges stacked alongside a former fisherman's garage, Flanders, Long Island, N.Y. Scallops were too scarce for harvesting in 2006 when this photograph was taken.

caught mostly codium and each of the 5 dredges behind it caught the scallops. The culling board across the boat's stern held the dredges.

We left the dock at 8:17 a.m. and headed for the scallop bed about 1.25

miles (2 km) southwest of the creek and about 0.3 miles (0.5 km) from shore. The bed appeared to be about 0.75 miles (1 km) long and 0.3 miles (0.5 km) wide. The water depth was about 4–5 ft (1.2–1.5 m) deep at high tide.

When we arrived, two other boats were dredging scallops but no others were seen all day (Fig. 102). The wind, blowing lightly at 5 knots from the southwest, produced ripples on the slightly green water surface. The wind ceased by 10 a.m. leaving the surface flat for the remainder of the day. The air temperature was 33°F (0.5°C); the water temperature was 37°F (2.8°C).

At 8:31 a.m. the fisherman began tossing over the dredges (Fig. 103); the 12th dredge was tossed 6 minutes later. We towed for about 10 minutes and then began to haul in and empty the dredges, one at a time (Fig. 104). I helped him pull in 4 of the dredges after each drift. We culled the bay scallops from the shack (codium, a red-brown alga, and scallop shells), and pushed it off both ends of the culling board (Fig. 105). At 9:13 a.m. we began hauling the dredges for the second time. Each dredge throughout the day had 3–10 scallops (average, about 6) each time they were hauled. Several slippersnails and a few jingle shells, *Anomia simplex*, were attached to most scallops (Fig. 106).

I asked the fisherman whether he was going to try harvesting on another

ground that day. He thought an area across the bay might have some scallops, and he wanted to try it in 1–2 weeks, but now he did not want to show the other two fishermen where it was. I asked what were the effects of codium on the fishery and he answered "It sometimes fills the dredges and they are so heavy it keeps the novice fishermen from scalloping."

We stopped dredging at 2:31 p.m. We had made 11 drifts and had 2.5 bushels of bay scallops. On the way to the creek, the fisherman explained that the 1985 brown tide kill of scallops was devastating to the fishing community, especially the fishermen and also the equipment suppliers, scallop openers, and truckers who had delivered the scallops to markets. It was a shock. There had been a huge set of scallops in 1984. The brown tide missed a few spots, and, in the 1985–86 season, some scallops were present to harvest.

Later in the day, the fisherman opened the scallops in his cellar and then sold them to a fish dealer. He had about 15 pounds of scallop "eyes." At \$16/lb, they would bring him about \$240.

My impressions of the environment and scallops were: 1) neither eelgrass nor starfish were present, 2) codium was fairly abundant, 3) market-sized scallops were scarce, and 4) only 10 "bug" scallops were observed.



Figure 102.—Hauling in a bay scallop dredge in Peconic Bay, N.Y., 31 Dec. 2005.

New Jersey

The bay scallop landings in New Jersey were recorded first in 1956, when 52,300 bushels were taken in Barnegat Bay (Fig. 107). The scallops were distributed within large but scattered eelgrass meadows spaced along a 12-mile (20 km) stretch near Barnegat Inlet, from Laurel Harbor, about 4 miles (7 km) north of the inlet, to Manahawkin Bay, about 8 miles (13 km) to its south. The water depths were 3–6 ft (0.9–1.8 m) (Camburn³⁸). Scallops were harvested in various annual quantities until 1968, when the landings ended almost for good. The peak landings after 1956 were in the 3-year period 1962–64, and they averaged 56,400 bu/yr. After 1968, landings were reported in only 1973 (10,000 bushels) and 1974 (2,700 bushels) (Ford, 1997).

The state regulated the bay scallop fishery, with an open season from 1 November to 15 April, a daily limit of 10 bu/day/person, and 20 bushels for a two-person boat. The scallops had to be opened into clean plastic or stainless steel containers; salad bowls were commonly used (Camburn³⁸).

About 100–150 boats were bay scalloping in the most productive years. Crewed by 1–2 people, some of whom were the fishermen's wives, most boats were square-ended garveys about 22 ft (6.7 m) long and propelled by outboard motors. Each towed 4 dredges. The remainder were 14–16 ft (4.3–4.9 m) rowboats, also outboard-motor powered. The dredges were made of iron rods and had a rigid bag (Fig. 108). Some seed scallops went through the spaces between the rods as they were being towed. During other seasons, many of the scallop fishermen sought northern quahogs and blue crabs in Barnegat Bay, Raritan Bay, and elsewhere (Camburn³⁸; Apel³⁹).

Fishermen placed the scallops in coffee-bean bags, about one bu/bag, loaded them onto small trucks, and drove them to opening houses or their

³⁸Camburn, G. W. Shellfisherman. Barnegat, N.J., Personal commun., 2006.

³⁹Apel, J. Fisherman. (ret.), Belford, N.J., Personal commun., 2006.



Figure 103.—Bay scalloper tossing out his dredge, Peconic Bay, N.Y., 31 Dec. 2005.



Figure 104.—Bay scalloper hauling his dredge hand-over-hand, Peconic Bay, N.Y., 31 Dec. 2005.



Figure 105.—The dredge contained a sulphur sponge, codium, slippersnails (*Crepidula fornicata*), the shells of northern quahogs, whelks, and bay scallops, and three live bay scallops, Peconic Bay, N.Y., 31 Dec. 2005.



Figure 106.—The bay scallops harvested in Peconic Bay, N.Y., have slipper snails and jingle shells, *Anomia simplex*, attached to them.

homes, though some were taken to Long Island, N.Y., to be opened. The largest bay scallops were found near Barnegat Inlet, and they yielded about 6 pounds of "eyes"/bu. Scallops farther away were smaller and yielded about 4.5–5 lb/bu (Camburn³⁸).

Scallops were opened by the fishermen, their wives, and people they

hired. The scallop season brought the family more money than it could earn at any other part of the year, so families worked hard while the scallops lasted in the beds. While husbands were harvesting, their wives were home opening the scallops caught the previous day, and then both opened in the evenings. One wife related that she had

suffered two miscarriages by lifting the heavy bags of scallops onto the opening benches. Some neighbors, who had full-time day jobs, opened scallops for the fishermen during weekday evenings. The scallop meats were sold to buyers who shipped them in 5-gallon, stainless-steel cans to Philadelphia and New York (Camburn³⁸).

Virginia

Bay scallops, *A. i. concentricus*, were once harvested along the eastern shore of the Delmarva Peninsula (Fig. 109). Lyles (1969) listed bay scallop landings in Virginia in only 6 years. This was between 1920 and 1932. They were lowest in 1920 at 19,000 bushels and highest in 1930 at about 300,000 bushels. The scallops were present in eelgrass meadows, and an estimated 200–300 boats may have been dredging for them. Bay scallop landings ended in 1931–32, when the eelgrass disappeared, and the scallops have never returned in commercial quantities (Terry⁴⁰).

North Carolina

North Carolina ranked third in annual bay scallop, *A. i. concentricus*, landings among the states, trailing Massachusetts but almost equal to New York. From 1898 to 1931, its landings averaged 90,000 bu/yr (range, 2,600–280,000 bushels). From the mid 1930's to late 1940's, the years when eelgrass was scarce and temperatures were warmer, the landings averaged 10,000 bu/yr (Lyles, 1969). From the beginning of the 1950's through the 1980's, the landings averaged 43,000 bu/yr (range,

⁴⁰Terry, N. Owner, Terry Oyster Company, Willis Wharf, Va., Personal commun., 2006.



Figure 107.—New Jersey bay scallops were harvested in Barnegat Bay, N.J., in areas at distances within several miles (km) north and south of Barnegat Inlet.

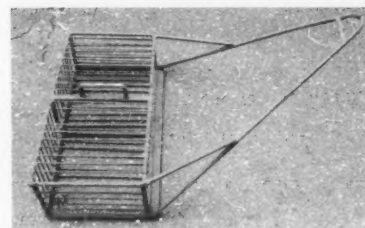


Figure 108.—The New Jersey bay scallop dredges were constructed entirely of iron and had a rigid bag.

7,500–127,000 bushels) (NMFS landings statistics). The landings declined after the mid 1990's and have been negligible during the 2000's (NMFS landings statistics) (Fig. 110). The decline was a consequence of a red tide event, caused by the dinoflagellate *Ptychodiscus brevis*, in 1987, several hurricanes in the 1990's, and predation by cownose rays. The North Carolina bay scallops are especially susceptible to hurricanes due to their frequent occurrences in the mid-Atlantic region of the U.S. coast. Hurricanes can cause direct physical damage to the scallops and their habitats, result in freshwater runoff, and damage waterfront property (Peterson et al., 2001; Myers et al., 2007; N.C. Fisheries Management Plan—Bay Scallops, 2007).

Bogue and Core Sounds

Bay scallops have been harvested in Bogue and Core Sounds, between the towns of Atlantic and Swansboro, and some were taken farther south inside New River Inlet and farther north along the inside of the Barrier Islands that form the east side of Pamlico Sound (Fig. 111, 112). Bogue and Core Sounds are about 26–32 miles (45–55 km) long; Bogue Sound is as much as 2 miles (3.5 km) wide and Core Sound as much as 3 miles (5 km) wide. Their average depth is 4–5 ft (1.2–1.5 m). Few areas are more than 6 ft (1.8 m) deep. Large areas, perhaps 80% in Bogue and Core Sounds that have been inhabited by bay scallops, are shallow enough for fishermen to wade and harvest scallops when tides are low (Smith²). The bottom sediments consist of firm, "sticky" mud, and a thin

mud layer collects on the upper shell of scallops (Fig. 113) (This contrasts with habitats in southern New England and New York, where the beds consist of sand and the scallops usually do not have sediments on them). The North Carolina scallops have inhabited the areas of eelgrass meadows and, to a much lesser extent, clusters of oyster shells. The North Carolina Division of Marine Fisheries suggests that the structure of oyster shells is suitable for the scallop settlement, but is not as good as eelgrass.

Origin of the Fishery

The town of Beaufort, located between Bogue and Core sounds, developed as a summer resort. North Carolina bay scalloping began as a summer fishery with sales to the summer people, and, in about 1860, the summer harvesting on the nearby shallows and sales of scallops began. The scallops thereafter were raked and scooped, and some scallops apparently were taken with dredges towed from rowboats. The scallops were peddled around the town for \$0.10/quart; the people hired to open them were paid at a rate of \$0.10–0.12/gal (Gutsell, 1929). In the 1870's, shipments of bay scallop meats began to out-of-state markets, mainly to New York City, Boston, possibly Philadelphia, and other locations. The scallop meats were packed in barrels (with ice?) and shipped northward by railroad from Morehead City, then a railhead. In 1876–77, several thousand gallons were shipped. At this time, fishermen were paid \$0.40–0.45/gal for the meats, and the openers were paid \$0.10–0.125/gal (Gutsell, 1929).

The bay scallop fishery developed quickly after 1912 or 1913, apparently because gasoline engines were being installed to propel boats, which then could dredge for scallops. From 1917 to 1924, nearly 700 fishermen/year were harvesting scallops. During 1922–24, about 2,000 men and women were employed as harvesters, openers, packers, icemen, and deliverymen. In 1917–18, 54,000 gallons of scallop meats were shipped. In 1927–28, if a fisherman and his family could not open all their

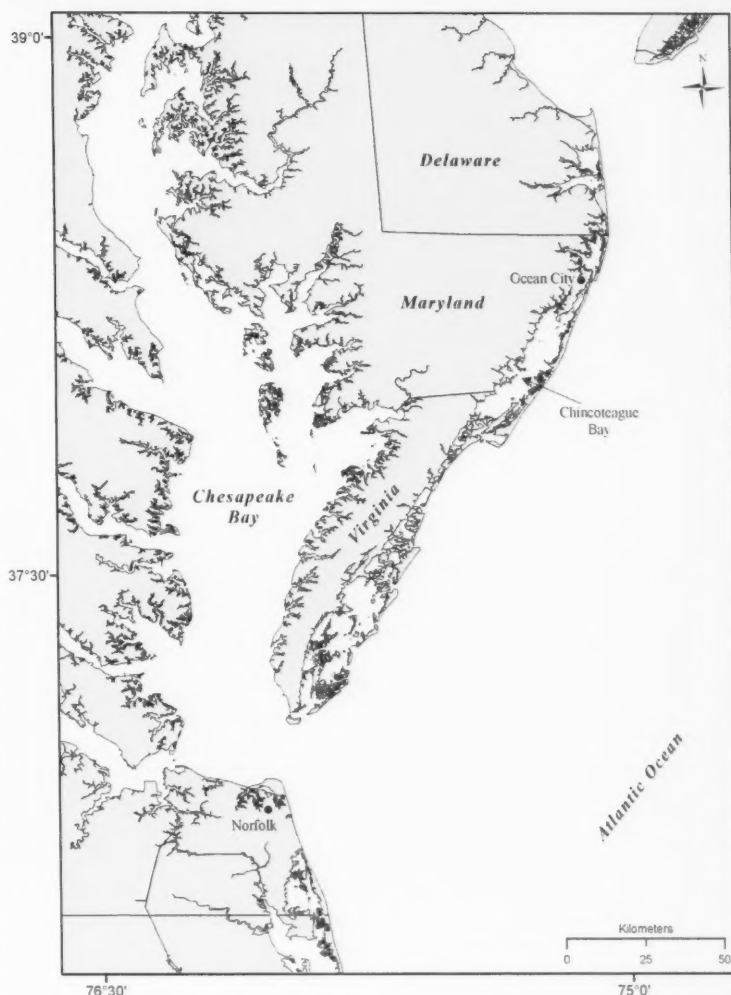


Figure 109.—Most Maryland and Virginia bay scallops were harvested in Chincoteague Bay.

scallops, they hired people to open the remainder and paid them \$0.50/gal. Fishermen delivered their bay scallop meats to the dealers by boat from various opening places around Bogue and Core Sounds. By the 1920's, small trucks became available to deliver them. The dealers washed and drained the meats and placed them in tin containers that held a gallon. The cans were packed with chipped ice in barrels, fish boxes, or half boxes for shipment to northern cities (Gutsell, 1929).

Regulations

In 1915, the state established the Fishery Commission Board with responsibility for fisheries regulation and law enforcement, and in July, 1917, it began to regulate scallop harvesting. The scallop season was from 1 December to 15 April, all scallops under 2 in (5 cm) from hinge to "mouth" had to be returned to the bottom, and it was forbidden to soak scallop meats or to sell soaked meats (Gutsell, 1929). Nearly all the com-

mercial crop consists of scallops 12–20 months old (Gutsell, 1929) and they are nearly full-sized (Fig. 114). The beginning of the season was later advanced to January. In the 1980's, the bay scallop season was open from about 1 January to late May (Smith²).

The relationship between meat weights and gonal development has

guided the State Division of Marine Fisheries in establishing the bay scallop season. The timing of the season allows for the completion of spawning and an increase in meat size to obtain the highest yield. During fall, the weights of the adductor muscles are at their lowest; this is when gonal development is high. When the scallops gradually finalize

their spawning in October, the muscles begin to increase and have their maximum weights from February to May (Fig. 115) (Spitsbergen, 1979; Kellogg and Spitsbergen, 1983).

The current regulations (N.C. Fisheries Management Plan—Bay Scallops, 2007) for bay scallops are as follows:

1. The scallop season is open briefly in December to allow the fishermen to earn some money for Christmas. This December opening lasts no more than 4 days.
2. The regular season is open between the second Monday in January and last Friday in May.
3. Between 1 August and 15 September, scalloping is allowed by hand harvesting only.
4. It is unlawful to take scallops between sunset and sunrise.
5. It is unlawful to take scallops with dredges weighing more than 50 pounds or equipped with teeth.
6. The daily limit is 10 bushels of scallops/person and 20 bu/two-person boat.
7. It is unlawful to soak scallops.

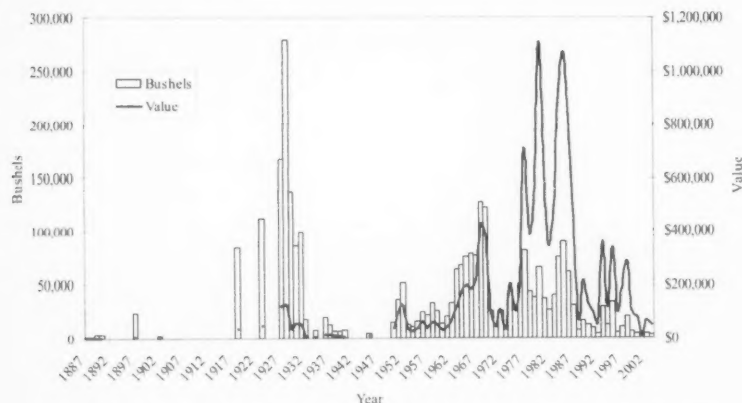


Figure 110.—North Carolina bay scallop historical landings and value, 1897–2003 (N.C. Fisheries Management Plan—Bay Scallops, 2007).

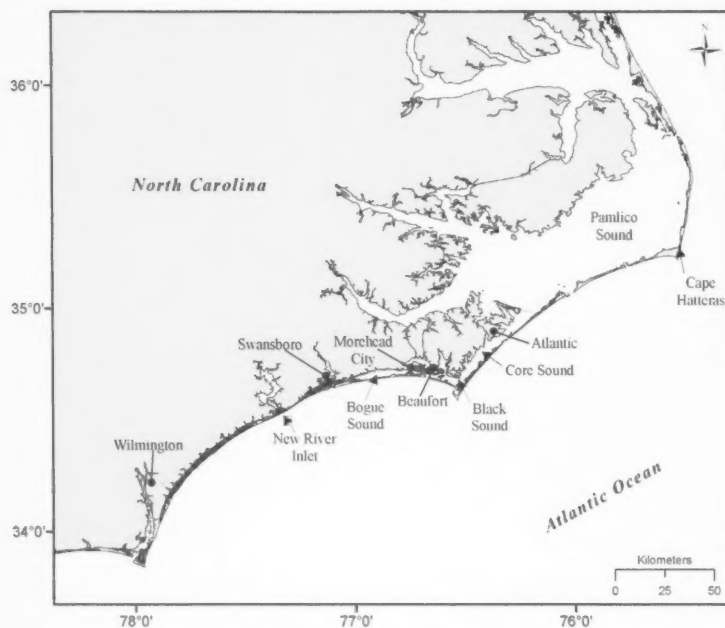


Figure 111.—North Carolina bay scallops were distributed from the towns of Swansboro to Atlantic in the Bogue Sound–Core Sound area.

The scallops are harvested from January through March with some taken in April (Fig. 116).

For many years, there was no formal limit on the daily catches that each fishermen or boat could take, but the state eventually did restrict the harvest to extend the scalloping season. The first ruling was 20 bu/person/day, and later it was 40 bu/two-person boat/day.

In different years, the State Division of Marine Fisheries allowed harvesting of bay scallops only on certain days. For instance in 1983, scallops could be taken by dredges on Monday and Wednesday and with scoops and rakes on Thursday and Friday in Bogue Sound, Core Sound, and New River. In January 1984, it allowed dredging and hand-harvesting (scooping and raking) only on Monday and Wednesday, but then in February 1984, it allowed both types of harvesting on Monday, Tuesday, and Wednesday and only by scooping and raking on Thursday and Friday. Commercial harvesting is not allowed

on weekends. A typical sequence of activity during a scalloping week that consisted of Monday and Wednesday harvesting by dredging was as follows (Smith²):

- 1) On Monday, a fisherman and his partner harvested 40 bushels of bay scallops with their dredging boat, and landed them on a shore in the early afternoon (Fig. 117). They and their families with hired help opened the scallops until about 10 p.m., usually having 5–6 gallons of meats by then. At least 300 people in the state were hired to open scallops. They included the fishermen, men and women of senior age, housewives, and school children. Many fishermen had their families work as openers: wives, sisters, and children. Some fishermen ordered their sons to open a gallon after school before they could play with their friends.
- 2) On Tuesday, fishermen and helpers spent all day opening the remainder of Monday's catch, and by early evening they had finished opening the 40 bushels and they trucked them to a local buyer; 40 bushels of bay scallops yielded about 25 gallons of meats (Fig. 118).
- 3) On Wednesday, they harvested another 40 bushels, and they opened the scallops into the night.
- 4) On Thursday, they spend all day and evening opening and selling the scallops.
- 5) On Friday, they repaired the netting on their dredges, scouted around the beds with rakes to find where the largest scallops were located, and got ready to harvest again on the following Monday (Fig. 119, 120). Two or three state shellfish officers enforce the regulations.

Dredging

Most scallops were harvested by dredging (Fig. 121). During the 1960's–

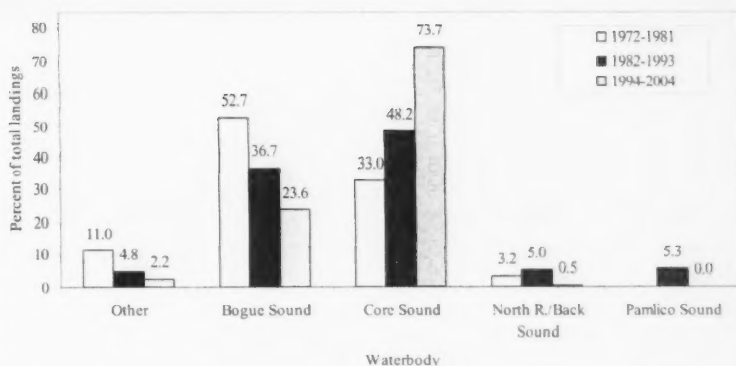


Figure 112.—Average percentage of total bay scallop landings by water body for three time periods, 1972–1981, 1982–1993, and 1994–2004 (N.C. Fisheries Management Plan—Bay Scallops, 2007).



Figure 113.—Bay scallops, *Argopecten irradians concentricus*, on the bottom of Bogue Sound, N.C., water depth, is about 2 ft (60 cm), February, 2008. A thin layer of mud lies on the scallops.

1980's, Bogue and Core Sounds had about 300 bay scallopers during the first part of an open season. About 75% were part-timers. If someone wanted to go scalloping and did not have the equipment, he could purchase an old

boat, motor, and dredges or borrow them for 2–3 weeks (Smith²).

The fishermen dredged for scallops during high tides in 2–4 ft (60–120 cm) of water. The dredges have caused little damage to the submerged aquatic

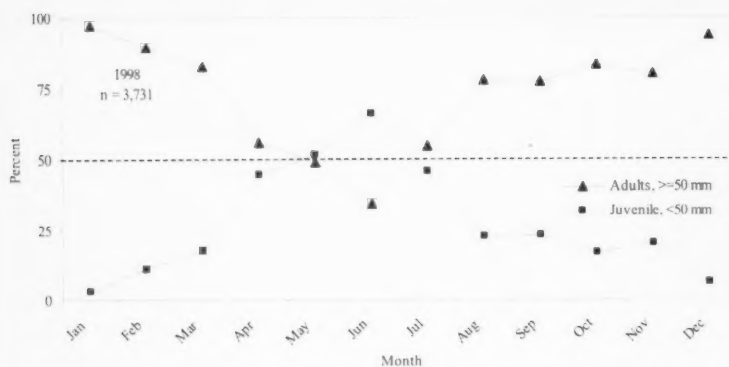


Figure 114.—The percentages of adult (>50 mm) and juvenile (<50 mm) bay scallops, *Argopecten irradians concentricus*, in North Carolina waters during each month of 1998. Dashed line shows 50% maturity for adults (N.C. Fisheries Management Plan—Bay Scallops, 2007).

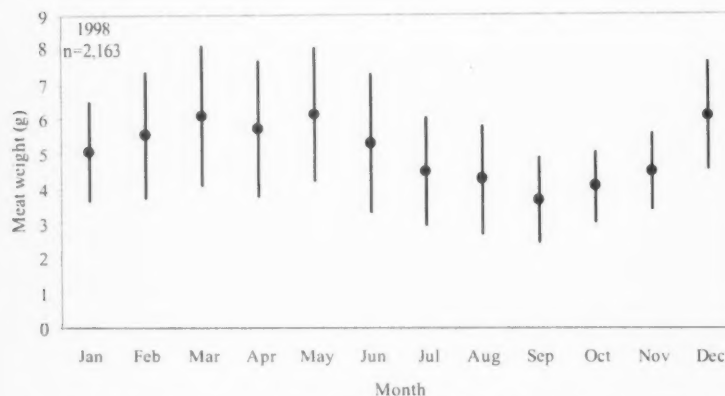


Figure 115.—Average monthly meat weights (g) of bay scallops, with one standard deviation from the mean, in 1998. The only scallops weighed had shell heights > 50 mm to ensure they were mature (N.C. Fisheries Management Plan—Bay Scallops, 2007).

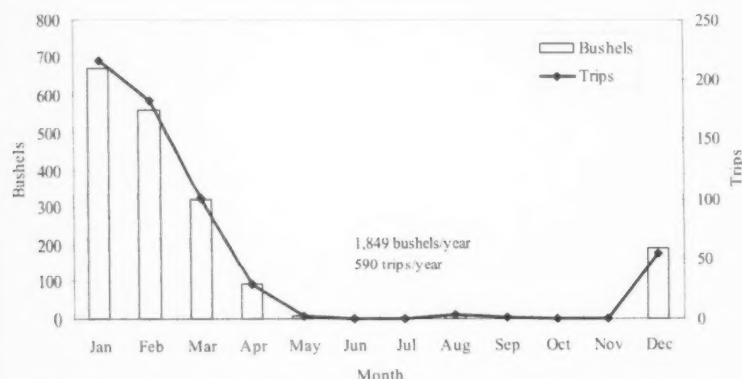


Figure 116.—Average monthly commercial landings (bushels) and trips in the North Carolina bay scallop fishery, 1994–2004 (N.C. Fisheries Management Plan—Bay Scallops, 2007).

vegetation (mostly eelgrass) because they glide over the substrate surface as they collect scallops, but propellers can scour the bottom as the boats pull the dredges. To minimize harm to the grasses, the state currently allows only scooping and raking early in the season, and, when the scallops are scarcer, dredging later in the season, and, to minimize the scouring, beginning the dredging each day during high tide (Smith²).

From 15 to 40 boats often crowded individual eelgrass meadows, even the smallest, where the scallops were abundant (Fig. 122, 123, 124, 125). They were able to harvest in their shallowest sections for 2–3 hours before the tide fell. Each boat could change its forward direction “on-a-dime” to avoid another boat due to the shortness of their dredge lines and location of their dredges close to the stern (Smith²).

Bay scallops were available so consistently each year during most of the 1960’s, 1970’s, and 1980’s that the regular fishermen considered their crops as “money in the bank,” providing them with financial security during winters. In many of the good years some boys left high school permanently to go scalloping and then remained as commercial fishermen (Smith²).

The fishermen liked periods when it rained because the salinity fell and the scallop adductor muscles swelled with lower salinity water, yielding more volume from their harvests. After the rains passed, the water became saltier and the meats shrunk back to normal size. Bay scallops also yielded more pounds of meat from a bushel measure late in a season, when their numbers had been thinned out by harvesting and they could grow larger muscles. North Carolina scallops usually run 70–80 meats/lb while the largest run about 50–60 meats/lb. The poorest meats run 100/lb (Smith²). The standard conversions used in the North Carolina landings database are: 50 pounds shell weight/bushel; 5 pounds of meat/bu; and 8 pounds of meat/gal (South Atlantic Commercial Monthly Landings Statistics and Detailed Shrimp Program User Documentation, 1992).

Raking and Scooping

The daily harvest of a scalloper, who raked or scooped, was far less than when he dredged (Fig. 126). The first rakes used may have been common potato diggers with a screen attached to retain the scallops. The rakers and scoopers wore hip boots or waders and walked slowly over the flats gathering scallops and putting them in large wash tubs, which they towed with a line attached to their waists. In taking each step, the fishermen's foot usually became slightly stuck in the mud and had to be pulled free, resulting in the fishermen becoming tired by the end of the day. In calm water, a fisherman with a scoop could harvest abundant scallops at a rate as high as 5 bu/hr. When the tubs were partially full, the scallops were emptied into skiffs or bunts that were anchored nearby (Gutsell, 1929).

As seasons wore on and scallop harvests dwindled, the fishermen gradually quit for the season as it was not worthwhile to continue. The cutoff quantity was about 3 bu/day. By the end of most seasons, from 10 to 15 scallopers remained harvesting. Some of the others had switched to digging quahogs. But near the end of those occasional seasons when the scallops were especially plentiful, the fishermen became tired of scalloping: They were "burned out" and so were the openers. Besides, in April, it was becoming warmer (Smith²).

When the scallop season ended, the fishermen, noted for being opportunistic, switched to other fisheries. They potted blue crabs during April, then from May 1st until early September they netted shrimp. In September, they caught fish (spot, *Leiostomus xanthurus*; mullet, *Mugil curema*; and sea trout, *Cynoscion nebulosus*) with haul seines on the Atlantic Ocean beaches (Smith²).

Opening and Washing Scallops

During the 1920's and 1930's, most bay scallops were opened out-of-doors under shelters, and also in garages and sheds, but later most were opened in 4-5 scallop houses in the town of Salter Path (Gutsell, 1929), and the remainder at the fishermen's homes. The scallop houses



Figure 117.—When their limits of bay scallops are harvested, North Carolina fishermen come ashore to load their catches onto trucks for transport to opening houses. Photograph courtesy of North Carolina DMF.



Figure 118.—North Carolina husband and wife opening their harvest of bay scallops, 1980's. Photograph courtesy of Neil Smith.

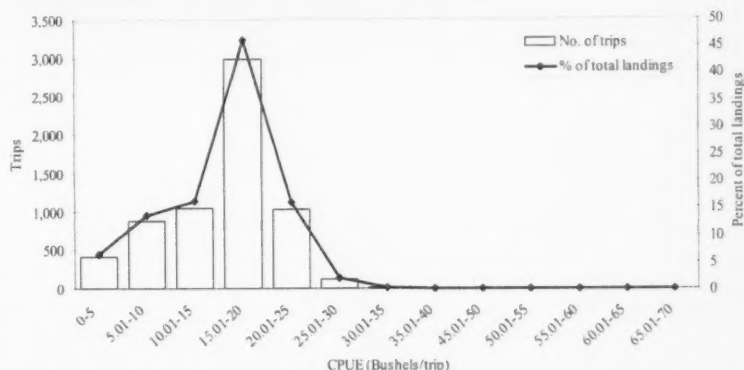


Figure 119.—The number of daily trips by North Carolina scallopers in each 5-bushel weight class of the commercial harvest of bay scallops, 1994–2004. Source: N.C. Fisheries Management Plan—Bay Scallops, 2007).

were constructed following the state's sanitary rules. The largest scallop house had about 50 opening berths with holes through the floor to discharge the shells and guts onto the beach below, and one or two had 7–8 berths each. The houses charged each fisherman \$2–3/day for

the space he occupied while opening his scallops (Smith²).

Standing or sitting in front of benches holding piles of freshly-caught scallops and using scallop knives, which were hand-made and ground from butter knives into the proper size and shape

in the earliest years and factory-made in later years, the openers flipped the meats into 1-gallon steel or plastic cans (Fig. 127). While doing so, they commonly ate several scallops along with some home-made biscuits. The shucked meats had some mud mixed with them, because mud was forced into scallops that were dredged. Packers had to wash the meats with fresh water. This removed flavorful juices from the surfaces of the meats, which then absorbed some fresh water, and the flavor of the meats was weakened (scallop meats in Massachusetts are not rinsed in fresh water). Packers were not allowed to hold the meats in fresh water long enough to absorb much water. The meats were packed in 1-gallon plastic cans, which were then set in boxes with crushed ice. Refrigerated trucks took the meats to northern markets (Smith²) (Table 6).

During the late 1970's and early 1980's, a scallop opening house purchased two machines for opening calico scallops, *Argopecten gibbus*, harvested in oceanic beds (Blake and Shumway (2006) report on the distribution of calico scallops in oceanic waters). Each machine could open 60–70 gallons of calico scallop meats/hr. The machines are successful when used for scallop muscles that are uniform in size, as are the calico's, but the size of bay scallop meats varies so much that the machines could not be used to open them: Too many muscles fell out of the set range of the machines, were chewed up, and had to be discarded (Smith²).

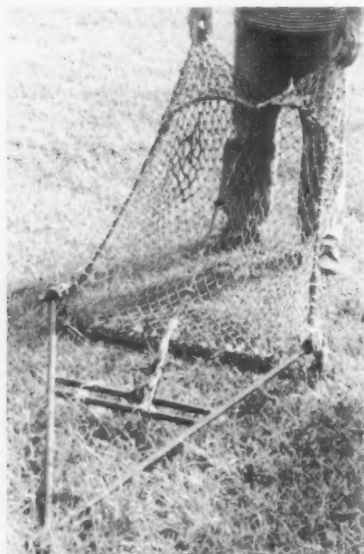


Figure 120.—North Carolina bay scallop fisherman getting one of his dredges ready.

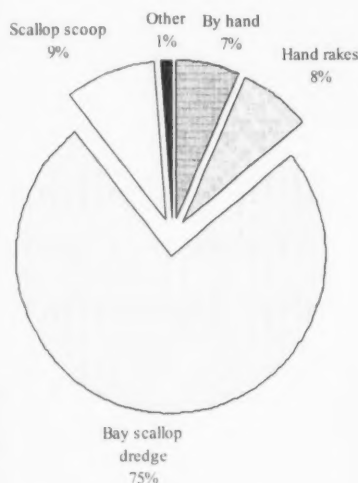


Figure 121.—Proportion of landings by gear types in the North Carolina bay scallop fishery, 1994–2004 (N.C. Fisheries Management Plan—Bay Scallops, 2007).



Figure 122.—Hauling in a dredge of bay scallops, Bogue Sound, N.C., 1980's. Photograph courtesy of North Carolina DMF.

Table 6.—Average commercial landings of bay scallops/yr, 2001–05, Atlantic and Gulf Coasts (Data from Massachusetts Division of Marine Fisheries (Mass DMF), local town reports, and NMFS Statistics and Economics Division, Silver Spring, Md.).

Location	Bushels	% total national landings	Source
Massachusetts			
Cape Cod Bay	17,000	24.0	Mass DMF
Cape Cod	6,120	8.7	Mass DMF
Buzzards Bay	19,500	27.6	Mass DMF
Martha's Vineyard (MV)	10,940	15.5	Mass DMF
Nantucket (Nan)	15,400	21.8	Mass DMF
New York	537	0.8	NMFS
North Carolina	1,200	1.7	NMFS
All others along Atlantic and Gulf Coasts	0	0	NMFS
National total	70,697		

Marketing

As time passed during the early 1900's, the bay scallop dealers began to grade the meats into 3 sizes, paying the fishermen most for the largest. In 1928, the dealers paid \$2.25–2.50/gal for large scallops, \$1.50–2.00/gal for larger mediums, and \$1.00–1.20/gal for medium scallops. The net earnings for each fisherman ranged from \$4 to \$15/day, after the expenses of opening and the wear and tear of their harvesting equipment were taken out (Gutsell, 1929). The practice of size-grading eventually ended.

Bay scallops were also eaten by local residents. They were prepared in three principal ways: 1) fried in a pan with a skim of oil on its bottom; 2) as the basis of soup; and 3) as a scallop fritter ("fridder") which contains scallop "hearts" chopped into pieces, flour, and eggs. They are mixed together to form a fridder and dropped into hot fat to be cooked (Smith²).

Recreational Fishery

In North Carolina, a recreational harvest of bay scallops is allowed at the same time as the commercial season, but recreational harvests may also be made on weekends. A license is not required. A state ruling limits the daily harvest to one-half a bu/person not to exceed one bu/boat (N.C. Fishery Management Plan—Bay Scallops, 2007).

Scarce Scallops Recently

Since the red tide of 1987–88, bay scalloping has nearly ended. Recruitments of juvenile scallops have been much smaller than they were, and fishermen have observed that cownose rays in large schools, that measure 50–100 ft (15–30 m) or more in width, enter Bogue and Core Sounds in some years and eat most of the scallops (Smith²) (Fig. 128, 129) (<http://www.huliq.com/16973/overfishing-sharks-wiped-out-north-carolina-bay-scallop-fishery>).

Fishermen try for scallops in the formerly productive grounds at the beginning of each season, but do not find enough to sell. The loss of this



Figure 123.—Culling scallops while dredging for more, Bogue Sound, N.C., 1980's. Photograph courtesy of North Carolina DMF.



Figure 124.—Wife and husband culling bay scallops while dredges are collecting more, Bogue Sound, N.C., 1980's. Photograph courtesy of North Carolina DMF.

fishery has been keenly felt, and some fishermen have had financial difficulty because unemployment insurance has not been available. The former rows of scallop opening houses appear like sections of ghost towns. Local residents feel that part of their heritage is gone (Smith²).

The North Carolina scalloping bays have become crowded with recre-

ational sail and motor boats during the warm summer months. During good weather, from 1,500 to 2,000 boats on weekends and 500 boats during the week occupy Bogue and Core Sounds (Moore⁴¹).

⁴¹Moore, J. U.S. Coast Guard Station, Fort Macon, Cape Hatteras, N.C., Personal commun., 2006.

Goals to Restore and Sustain Harvests

The State Division of Marine Fisheries has published a management plan titled, *The 2007 North Carolina Fishery Management Plan—Bay Scallops, 2007*, to preserve the bay scallop resource and promote the scallop fishery. The goals were:

1. Develop an objective management program that restores and maintains sustainable harvest.
2. Promote the protection, restoration, and enhancement of habitats and water quality necessary for enhancing the fishery resource.
3. Identify, enhance, and initiate studies to increase our understanding of bay scallop biology, predator/

prey relationships, and population dynamics.

4. Investigate methods for protecting and enhancing the spawning stocks.
5. Address social and economic concerns of all user groups.
6. Promote public awareness regarding the status and management of the North Carolina bay scallop stocks.



Figure 125.—Removing bay scallops from culling tray in Bogue Sound, N.C., 1980's. Photograph courtesy of North Carolina DMF.

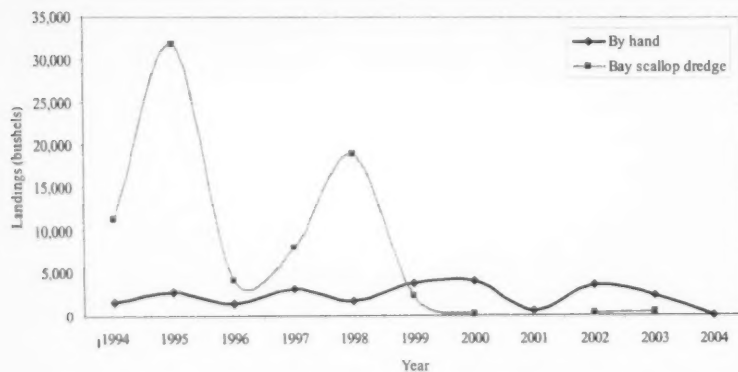


Figure 126.—Annual bay scallop landings separated into hand (scoops and rakes) and dredge harvesting methods in North Carolina, 1994–2004. (N.C. Fisheries Management Plan—Bay Scallops, 2007).

Habitat Changes and Reduced Landings

Along the Northeast U.S East Coast

In 1985, the stocks and consequent landings of the northern bay scallops crashed to extremely low amounts in nearly all its formerly productive bays, and the scallops have remained scarce. In locations, such as southern Cape Cod, Buzzards Bay, Rhode Island, Connecticut, and eastern Long Island, bay scallop landings have been extremely small or do not exist (Fig. 130). Before this, from about 1950 to mid 1980's, their landings had been relatively large at times.

The main cause of the crash was an eruption of the picoplankter, *Aureococcus anophagefferans*. In Buzzards Bay and the bays along southern Cape Cod, the brown tide in 1985 was not evident to the local people who viewed the waters casually, but the scallop landings there similarly crashed in that year. Possibly, thin, but unrecognized, blooms of *A. anophagefferans* may have been responsible. Coincident with the scarcity of scallops, eelgrass meadows have become scarcer in the bays. More brown tides followed in some years through 1995, but none have occurred after that. Nevertheless, the scallop landings have remained small. The agent that caused the crash apparently missed the waters around Falmouth and on Martha's Vineyard and Nantucket in Mass. and on the bay side of the few inlets in southwestern Long Island, N.Y., because bay scallop harvests have continued.

Since 1985, the specific factors that have changed in the scallops' habitats to prevent the scallops from becoming abundant again are imperfectly known. The obvious changes have been warming waters and a changing climate and

increases in human habitation on the shores and watersheds, with consequent nitrogen pollution, and also during summers a large amount of recreational boating in bays. These factors have potential effects upon physiology of the scallops at all their life stages, phytoplankton, and predation. The harvesting of the bay scallops, by itself, seems to have had little effect on the recruitment and abundances of the harvestable stocks.

Effects of Brown and Red Tides

In 1985, a dense bloom of the brown picoplankton, *Aureococcus anophagefferans*, developed across almost the entire extent of Peconic Bay in Long Island and Narragansett Bay in Rhode Island and endured for several weeks. The bloom was referred to as "brown tide" due to its color and dense concentration in waters that had been relatively clear. The brown tides in Peconic Bay and Narragansett Bay resulted in the deaths of nearly all bay scallops, mussels, *Mytilus edulis*, oysters, and eelgrass (Bricelj et al., 1987; Cosper et al., 1987; Bricelj and Kuenstner, 1989; Nuzzi and Waters, 1989; Bricelj and Lonsdale, 1997). Some bay scallops may have spawned, but their larvae could not use *A. anophagefferans* for food efficiently (Gallagher et al., 1989). No one is sure what the environmental conditions were when the brown tides occurred, but Smayda and Borkman (2000), referring to the 1985 brown tide in Narragansett Bay, reported that it developed during a period of drought, low river flow, and high sunlight radiance.

In 1981–85, landings of bay scallops on Long Island, N.Y., had averaged 54,500 bu/yr, but between 1985 and 2004, they averaged 3,570 bu/yr. Included are the landings 45,200 bushels in 1994. Aside from that year, the landings for the remaining 18 years averaged 1,250 bu/yr (NMFS landings statistics). The former scalloping grounds in Peconic Bay have remained nearly barren of eelgrass meadows. Rhode Island has not had commercial bay scallop landings since 1985.

In North Carolina, the eruption in abundance of the dinoflagellate, *Ptychodiscus brevis*, produced an intense



Figure 127.—Opening bay scallops harvested in Bogue or Core Sounds, N.C., 1980's. The shells and "guts" are dropped into holes on the benches leading outside the shed. Photograph courtesy of North Carolina DMF.

poisonous "red tide" in the scalloping bays in 1987–88. About one-fifth of the adult scallops died and the survivors apparently had much reduced spawning. In both 1987 and 1988, the numbers of scallop recruits were about one-fiftieth of the pre-red tide densities (Summerston and Peterson, 1990). Bay scallops have been scarce in North Carolina ever since, in part due to hurricanes and predation by cownose rays (Peterson et al., 2001).

Environmental Changes After 1985–95

Since 1985–95, bay scallops have remained relatively scarce in most of the bays. The full range of changes in their habitats that have prevented them from becoming abundant again are not fully understood. One reason that bay scallops have become scarce is partly due to their apparent fragility and sensitivity to environmental conditions. In hatchery environments, scallop juveniles are more difficult to produce than the juveniles of oysters and northern quahogs. Their eggs do not fertilize as readily,



Figure 128.—The cownose ray. Source of illustration: Bigelow and Schroeder, 1953.

their larvae will grow only when fed the best available phytoplankton, their mortalities are higher when the larvae are to metamorphose and set, and the juveniles may die if handled similarly to oysters and northern quahogs. Furthermore, each mature scallop produces fewer eggs than either of the others (Zatila⁴²). It is

⁴²Zatila, J., F. M. Flower and Sons, Oyster Bay, N.Y., 2007.

highly probable that even slight changes that have degraded their habitats would lower their abundances.

There have not been any broad estuarine studies that have considered the bay scallop as their focal point, but reviews of several findings and other observations show that their habitats have changed in ways that would be expected to adversely affect bay scallops:

- 1) The water temperatures have become warmer especially during winter and the climate has changed;
- 2) the composition of phytoplankton species and the timing of their blooms have changed;
- 3) predation may have increased, since decapods are more abundant;
- 4) eelgrass is less abundant;
- 5) pollution, especially nitrogen levels, has increased; and

- 6) some physical changes have occurred.

In addition, there have been increases in human habitation adjacent to the shores and watersheds, bringing with it an increase in nitrogen pollution and in recreational boating in the bays.

An increase in water temperature can affect the physiology of scallops and also the phytoplankton species, predation rate, and eelgrass survivorship. Regarding phytoplankton, diatoms (*Skeletonema costatum* is the dominant species) have become less abundant in the late spring–early summer and more abundant in the summer and fall than before, and chlorophyll levels have declined sharply at least in Narragansett Bay (Li and Smayda, 1998; Smayda et al., 2004). This shift in diatoms may be the reason for a shift in the pattern of the bay scallop reproduction. There

have been fewer seed found in the early summer and some seed is found in the late summer–early fall, in eastern Long Island, N.Y., Nantucket, and Martha's Vineyard. There used to be fewer seed in the fall. Does this decline in chlorophyll mean that other phytoplankton species have declined and there is less food for scallops? Oviatt (2004) and Wood et al. (2008) have shown that decapods (crabs and perhaps shrimp), that are predators of bay scallops, have become more abundant. Losses of eelgrass (Hughes et al., 2002; Anonymous, 2006; Fonseca and Uhrin, In press) have had a great affect on the habitat and the bay scallops (fewer scallops exist where it has disappeared). The effects of pollutants, such as nitrogen and PAH's, directly on the scallops have not been determined, but the presence of nitrogen in the warmer waters has caused eelgrass abundance to decline (Bintz et al., 2003). Some bay inlets have changed by becoming smaller or larger in a few locations. Harvesting bay scallops seems to have had little effect on the recruitment and abundances of the harvestable stocks.

Martha's Vineyard and Nantucket: Two Areas of Continuous Production

An overview of the recent history of bay scallop landings and environments on Martha's Vineyard and Nantucket may provide more insights into the causes of bay scallop scarcities in the northeastern U.S. bays. Martha's Vineyard lies 5 miles (8 km) and Nantucket lies about 20 miles (32 km) south of Cape Cod. The two islands are 15 miles (24 km) apart. On their north sides, the islands are bordered by the waters of Vineyard and Nantucket Sounds, and on their south sides by the Atlantic Ocean. Since the waters of the islands' bays exchange directly with these waters, especially those of the two sounds, they likely are strongly influenced by their temperatures and they probably receive phytoplankton from them. Thus the air temperatures and consequent water temperatures of the islands' bays may not be warmed and cooled as much by the land masses of Cape Cod and Massachusetts, as are the other bays

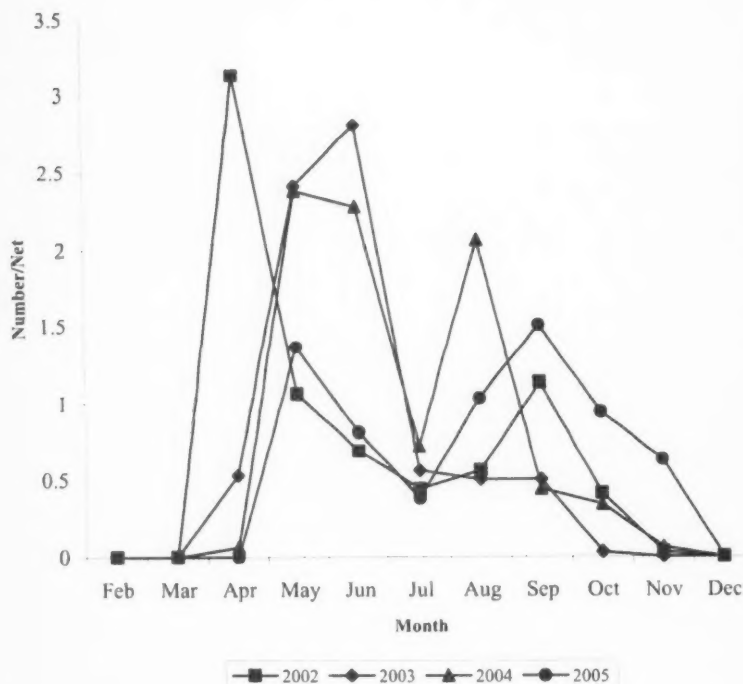


Figure 129.—Monthly catch per unit of effort (number/net) of cownose rays in Pamlico Sound from an independent gill net survey (N.C. Fisheries Management Plan—Bay Scallops, 2007).

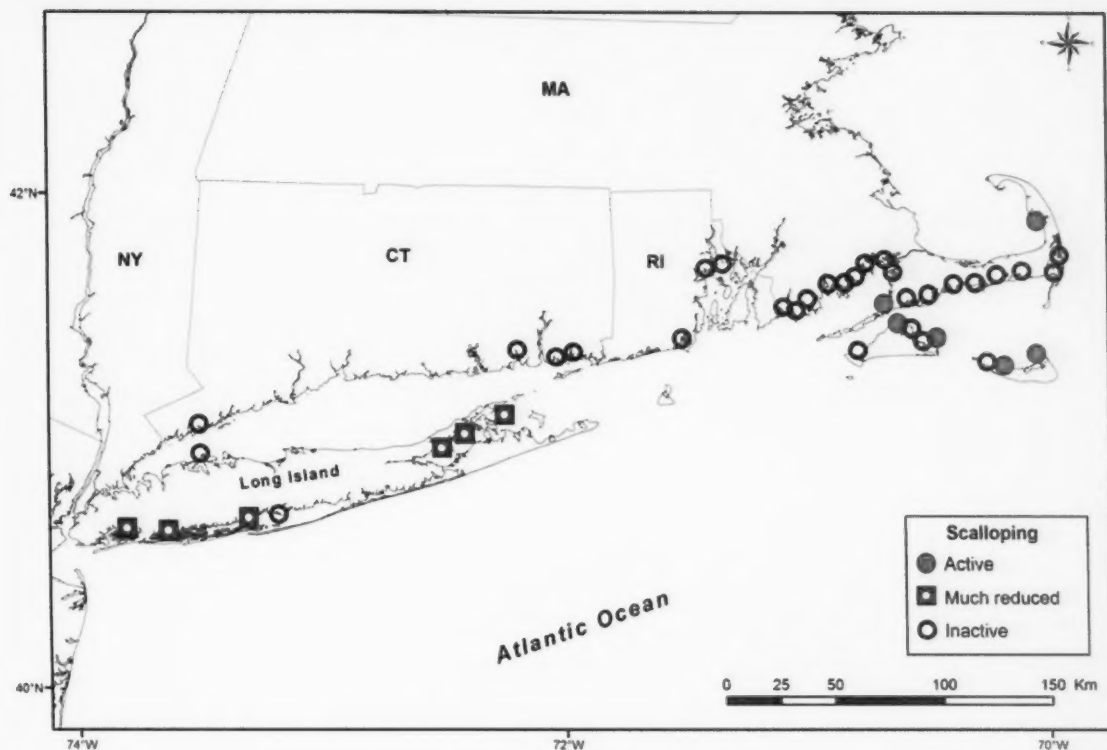


Figure 130.—Bay scallops, *Argopecten irradians irradians*, in the region from Cape Cod to western Long Island have become much scarcer than they were before 1985. The solid circles show where scalloping still exists; the squares show where scalloping continues but on a much reduced scale; and the open circles show where scalloping does not continue.

in this state, yet since they are broad, shallow, and have small openings to Nantucket Sound, they may be warmer than they once were. Besides those factors: 1) a larger number of permanent and summer people reside on them, 2) recreational boating increased in some of their harbors during summers, 3) the extent of eelgrass meadows has declined slightly, and 4) at least in Edgartown, the openings of two bays have changed substantially.

Between 1980 and 2000, permanent residents on Martha's Vineyard increased from 8,879 to 14,901 (<http://www.mv-commission.org/resources/profile.html>), or 40% more, while on Nantucket they increased from 3,774 to 9,520, 60.4% more.⁴³ The summer tourist popula-

tion has increased sharply also. But the islands' watersheds are relatively small and the total build-up of homes on the watersheds probably is much smaller than on those on the mainland.

The islands have been spared three types of changes that the other bay scalloping locations have suffered: 1) either no brown or red tides, or at least none that were recognized; 2) probably less water pollution from nutrients and consequent eutrophication of waters and other pollutants; and 3) apparently a far smaller decline in the extent of eelgrass meadows than elsewhere.

On Martha's Vineyard, bay scallop landings were about 40% as high during 1990–2005 (avg. 10,869 bu/yr) as they were in 1975–89 (avg. 28,674 bu/yr). Some of this decline has resulted from the closure of the southern opening in Katama Bay, and in the loss

of eelgrass in Sengecontacket Pond (Fig. 131). The southern opening of Katama Bay reopened after being closed for about 25 years in April, 2007 (Fig. 132). On Nantucket, the landings were about 30% as high in 1990–2005 (avg. 15,400 bu/yr) as they were in 1978–89 (avg. 54,200 bu/yr). Cape Poge Pond (9%) on Martha's Vineyard and Nantucket Harbor and Madaket Bay (22%), taken together, currently produce about 30% of the commercial bay scallops landed along the entire East and Gulf Coasts of the United States (town annual reports, and NMFS landings statistics).

Cape Poge Pond, Nantucket Harbor, and Madaket Bay

Descriptions of the environments in Cape Poge Pond, Nantucket Harbor,

⁴³<http://www.censusscope.org/us/s25/c19/chart-pl.html>.

and Madaket Bay may provide further insights regarding the decline in other areas. They did not seem to be impacted substantially by an increase in the number of people inhabiting their shores, a large number of boats, pollution, eutrophication, and losses of eelgrass, and the sizes of their openings to Nantucket Sound waters have not changed.

Scallops are distributed in the northern one-half to three-fifths of Cape Poge Pond, where depths are 5–9 ft (1.5–3 m), the bottom sediments consist of firm sand and eelgrass covers about 50% of the bottom. The southern part of the pond, at least near its center, is deeper (12 ft or about 4 m), and it has a muddy bottom and no eelgrass. From 1991 to 2004, Cape Poge Pond (4,415 bu/yr, avg.) produced 88% of Edgartown's bay

scallops (5,025 bu/yr, avg.) and 57% of Martha's Vineyard's total (7,754 bu/yr, avg.). During that time, the landings from Cape Poge varied among years but there was no trend upward or downward (Fig. 133). Separate landings data from Cape Poge Pond were not tallied earlier than 1991, so there is no record of whether the earlier landings were higher (various town annual reports).

The shoreline of Cape Poge Pond and its narrow watershed have always been nearly clear of housing, in part because the area is rather remote and construction of new houses is not allowed. Summer recreational boating is negligible on the pond, and overnight anchoring of boats is not allowed, as part of an effort to protect the pond's environment. Moreover, there are no obvious sources of pollution. The pond

has several species of finfish, crabs, and shrimp (Fig. 134), that might prey on scallops but no starfish.

Nantucket does not maintain separate records of bay scallop landings for each of its three harvesting areas: Nantucket Harbor, Madaket Bay, and the Tuckernuck Shoals. Some of the decline in overall Nantucket landings is a result of the large dropoff in harvests from the Tuckernuck Shoals probably because the eelgrass has mostly disappeared, but some has resulted from a decline of unknown magnitude in the other two areas (Conant¹).

The quality of the environments in Nantucket Harbor and Madaket Bay appears to be fairly good for scallops. The waters in the harbor may be degraded a little by 1) the presence of a large number of recreational boats that anchor in the west end of the harbor near the town during the summer, and 2) a small increase in the numbers of homes that have been constructed along its south shore bringing with it a potential for causing eutrophication. Eelgrass meadows cover 50–60% of the harbor and nearly all of Madaket Bay. The loss of eelgrass between 1995 and 2001 is estimated to be only about 10% in Nantucket Harbor and 5% in Madaket Bay (Anonymous, 2006). Nantucket Harbor does not have any starfish, but various species of finfish, crabs, and shrimp, that might prey on bay scallops are present.

Environmental Protection on the Two Islands

Karney (2000) described how, in the late 1980's and early 1990's, neighborhood pond associations have formed on Martha's Vineyard with the goal of preserving the island's natural environments and shellfish resources. All groups have been effective in funding studies of water quality in the local waters. Whenever the data collected showed signs of pollution, the groups have implemented some corrective measures, and they were responsible for installing free stations to pumpout sewage from boats. Through newsletters and annual reports, the members are kept informed of ongoing projects and steps they can



Figure 131.—Eastern Martha's Vineyard, Mass., showing the bay scalloping locations. 1. Northern part of Cape Poge Pond where bay scallops are relatively abundant. 2. Southern part of the pond where scallops are scarce. 3. A sand bar across the south end of Katama Bay; at times in the past, an opening in the bar allowed ocean water to pass into the bay and provide a good environment of bay scallops. 4. Dashed line shows location of sand bar that formed the outer edge of the Eel Pond; the bar washed away during a storm in 1991. The former Eel Pond became a cove.



Figure 132.—A strong southeast wind storm in April, 2007 produced rough Atlantic Ocean (lower left) seas that forced a wide opening through the sand bar across the south side of Katama Bay (upper right), Martha's Vineyard. Katama Bay once was a large producer of bay scallops. Photograph courtesy of Dick Sherman, Copyright 2008 Vineyard Gazette.

take to ensure good water quality. Due in part to their vigilance, 98.8% of the island's 175,000 acres of waters are approved for harvesting shellfish, based upon coliform bacteria counts.

Similarly, the people on Nantucket try to preserve the island's waters and undeveloped land by opposing any threatening developments. An environmental conservation report (Anonymous, 2006) describes the purpose, scope, and authority of the Nantucket and Madaket Harbors action plan: "The plan presents the community's goals, objectives and recommendations for guiding public and private use of the land and water of its harbor areas and establishes an implementation program to achieve the desired outcomes."

Each Martha's Vineyard town takes actions to aid its bay scallop fisheries. One is to contribute financial support to the Martha's Vineyard Shellfish Group, Inc., which operates a bivalve hatchery on Lagoon Pond in Vineyard Haven (Fig. 135, 136). In return, the Shellfish Group produces juvenile scallops, northern quahogs, and softshell clams for the shellfish officers of individual towns to grow in bags (Fig. 137) and

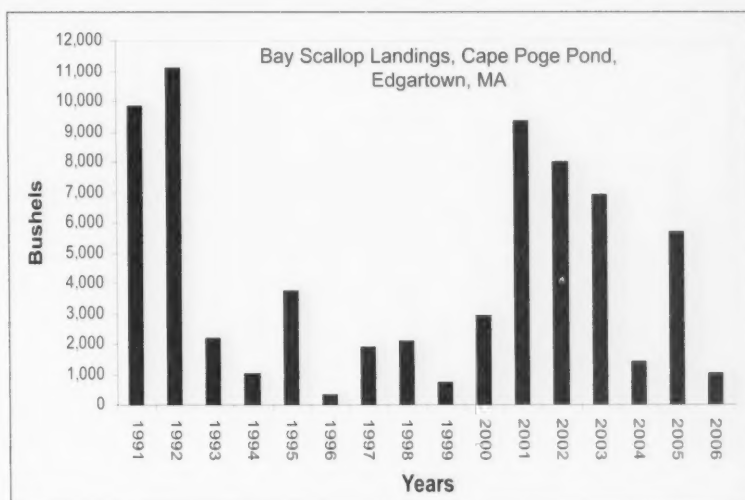


Figure 133.—Annual bay scallop landings in Cape Poge Pond, Edgartown, Martha's Vineyard, Mass., 1991–2006. Source: Town of Edgartown annual town reports.

then spread in their bays and deploy in their floating spawner trays (Gaines⁴⁴). Besides dealing with hatchery seed, the

shellfish officers also transplant some wild seed to locations where the bottoms are safer or provide better conditions for scallop growth. The poor locations are the grounds outside the ponds and where scallops are overcrowded or exposed to

⁴⁴Gaines, W. Shellfish Officer, Edgartown, Mass., Personal commun.

storms on shallow flats. Their other actions also include trapping green crabs and planting eelgrass.

Conclusion

In contrast to the bays of Martha's Vineyard and Nantucket, the bays else-

where in Massachusetts and in Rhode Island and eastern Long Island may be affected by higher concentrations of nutrients, which can stimulate the growth of blooms of some phytoplankton species that may not be foods for the bay scallops, and perhaps toxic chemicals.

Some locations also have much less eelgrass than they had. The increase in boating in the various harbors probably has some negative effect on the scallops (Moore⁴⁵).

Attempts to Restore Atlantic Coast Bay Scallop Fisheries

Some Restoration Efforts

The principal actions to increase the sizes of bay scallop populations have been to plant seed and adult scallops and eelgrass in the bays (Arnold et al., 2005, provides a more extensive account of bay scallop restoration actions). The efforts have been made in every east coast state that has had a bay scallop fishery: Massachusetts, Rhode Island, New York, New Jersey, Maryland, Virginia, and North Carolina. They include activities by the states, counties, towns, fishermen's associations, and university groups, but most have been modest in size. Though the scallops have not increased to their former abundances anywhere, the declines in landings might have been steeper without the restoration efforts. The restoration of former eelgrass meadows has been only partially successful. Most areas where eelgrass has died out since the 1980's have remained barren (See Fonseca and Uhrin, In press).

Bay scallops have been placed in the bays in at least three ways.



Figure 134.—Fishes (pipefish, cunner, grubby, stickleback, and winter flounder) and grass shrimp, *Palaemonetes pugio*, caught by predator dredge in eelgrass meadows, Cape Poge Pond, in July, 2007.



Figure 135.—Juvenile bay scallops, a few weeks old, were reared in a hatchery in Southold, N.Y.



Figure 136.—Tray for holding mature bay scallops for spawning in bays. The purpose is to seed the bays with juvenile scallops, Martha's Vineyard, Mass.

⁴⁵Moore, S. Shellfish officer, Chatham, Mass., 2007.

- 1) Adult scallops are held in trays to spawn and produce scallop larvae for the bays. The trays measure 6–10 ft × 3 ft (2–3 m × 1 m) and usually float on the water, but some are laid on the bottom. Each contains 50–100 mature scallops, and individual trays are placed at considerable distances from one another. The scallops in floating trays are easier to maintain than scallops in trays resting on the bottom. But the scallops in surface trays are subjected to a wider range of temperatures and are also disturbed by surface waves.
- 2) Hatchery-reared seed are grown initially in bags to a length of about 1.5 in (40 mm) and then spread on the bottoms that used to produce scallops. The seed eventually would produce sperm and eggs and also be available for harvesting after growth to legal size. Some seed have had genetic “tags” (a unique color mark) on their shells, so management officials can determine whether the scallops that fishermen harvest are actually hatchery-reared scallops. The survival of the scallops has not been measured. This method involves thousands of scallops.
- 3) Scallop larvae are reared in hatcheries and released in bays when at the pediveliger (ready-to-set) larval stage. This method can involve millions of scallops. No one has determined the percentage of pediveligers that set or the survival of the juveniles.

The Cornell University Cooperative Extension of Suffolk County Marine Program, Riverhead, Long Island, N.Y., listed some observations and recommendations for planting bay scallops in ways to minimize the losses they had encountered (Smith⁴⁶):

- 1) Plant large scallops. Make sure they are over 1.4 in (35 mm) long, best over 40 mm, because smaller scallops may be lost to predation, or are widely dispersed. The success will be better if 500,000 scallops at a size of 1.4–1.6 in (35–40 mm) are planted rather than 1 million scallops at 0.8–1.1 in (20–27 mm).
- 2) Overwintering can be a problem because many scallops die or disappear. Put the scallops in eelgrass meadows or in headwaters protected from northwest winds.

Free planting on the bottom can mean large losses from predation and shifting sediments. One scallop planting had a 30% survival overwinter; the scallop density fell from 8 to 3/m².

- 3) Scallops can be held best in Nesteer trays⁴⁷, cages, or lantern nets. Lantern nets are difficult to open and close, and some locations in the nets are inconvenient to clean. When used in shallow areas in winter, algae has to be scrubbed from them every few weeks.
- 4) Spread scallops at a density of 5–7/m². Denser plantings attract more predaceous crabs.

Another enhancement method used on a pilot scale has been to place meshed monofilament bags on scallop beds. The bags are a bushel or two in size, and filled with coarse-mesh monofilament screening. Scallop larvae can set and grow in the bags, and they are protected from predators. The bags later are opened to release the juvenile scallops onto the beds. In practice, scallop recruitment into the bags has been highly variable by location and year. Some bags

⁴⁶Smith, C. Cornell Cooperative Ext., Riverhead, Long Island, N.Y. Personal commun., 2006.

⁴⁷Mention of trade names or commercial firms in this paper does not imply endorsement by the National Marine Fisheries Service, NOAA.



Figure 137.—Edgartown shellfish officer examining bag of seed bay scallops in Cape Poge Pond, Martha's Vineyard, Mass., 2007. The seed were produced by the Martha's Vineyard Shellfish Group.

have not collected any scallops, whereas others have as many as 1,500 juveniles (15–20 mm long)/bag. Whenever bags were placed out too early (before the scallops set), each has collected hundreds of juvenile mud crabs and few or no scallops (Sherman⁹).

From about 1975 to 1985, the State of Rhode Island, under the direction of the Department of Environmental Management, attempted to reestablish bay scallop populations by placing seed scallops in the state's coastal ponds. Its personnel obtained scallops, about 0.5 in (12 mm) in diameter, from hatcheries, and put 5 bushels in each of Winnapaug, Quonochontaug, Ninigret, Charlestown, and Point Judith ponds. The seed was planted in the ponds' southwest corners, so afternoon southwest winds would blow the surface waters and hopefully scallop larvae across them. The seed grew and eventually spawned. Light sets of scallop seed were found, but few survived. The project ended when the 1985 brown tide killed the scallops (Ganz³⁰). Eelgrass has been planted in some areas where meadows once grew in Rhode Island with moderate success, following the recommendations of Fonseca et al. (1998).

Super-sized Planting

The Cornell Cooperative Extension Marine Program and Long Island University are undertaking a bay scallop restoration in Peconic Bay that will involve holding large numbers of spawners in two areas for four consecutive years. The purpose is to provide huge spawning stocks so large numbers of seed scallops will be produced. The idea is to see whether large numbers of seed scallops after they grow to maturity and spawn will produce another large amount of seed, thereby restoring the original size of the scallop stock. Some seed will be scattered over bottoms, but most will be held in suspended Nester nets that are placed in at least 5 long rows; the nets in each row are close together to enhance to possibility of egg fertilization. One site will have 500,000 spawners and the other 100,000 spawners. The scallops will possess a unique genetic makeup

that will enable the project managers to determine whether the scallops later found in the bay were actually progeny of the program's scallops. This will be done in two former scalloping areas, but unfortunately they are nearly devoid of eelgrass.

The recovery effort began in 2005 (Davis, 2005). Few seed resulted from the spawners in 2005 and 2006, but the set on the bottom in 2007 was from 8 to 80 fold denser/unit area near the sanctuary with 500,000 spawners than in the other former scalloping areas some distance away (Pickerell, 2008). Skeptics believe that such a program may be only partially successful unless the eelgrass meadows are restored ahead of time (Toy, 2004), but restoration of eelgrass meadows is difficult to achieve because the meadows might not grow abundantly in the bay in its current environmental condition.

Temporarily Suspend Harvesting?

A plan often suggested for restoring northern bay scallops is to suspend commercial harvesting for a year or two so the beds and seed scallops will not be disturbed. This probably would not be successful, because near the beginnings of scalloping seasons in Massachusetts and New York the scalloping beds are checked for the presence of commercial quantities of scallops by a few boat crews for a day or two. When only small quantities are present no further dredging continues, so the beds are little disturbed by the scallopers until the following season.

A Management Suggestion

Bay scallop spawning sanctuaries could be redesigned. In areas where scallops used to be present and the eelgrass has disappeared, artificial eelgrass could be installed to hold mature scallops. Mats of artificial eelgrass, perhaps 15 ft square (4.5 by 4.5 m), could be secured to the bottom in several places within selected bays. The spawning of the scallops might be better and the fertilization rate of the eggs would likely be higher than they would be on plain bottom (artificial eelgrass suggestion by V. G. Burrell, Jr., Marine Resources

Institute, South Carolina Dep. Natural Resources, Charleston).

Suggested Future Studies

Several studies can be suggested to help gain additional information about the factors that control the abundances of bay scallops. A multi-year field study could be made to determine the survival rate and the causes of mortality of bay scallops, sampling at least every two weeks because the changes might be rapid. The study would begin when their larvae first settle onto substrates and continue until the scallops attain market size 18–30 months later. This could be accomplished in various types of habitats, as was done with the oyster in Long Island Sound by MacKenzie (1981). The answers to the following questions could provide further useful information. After being collected, managers would know whether any actions could be taken to improve habitat conditions of the scallops and other marine life in the bays.

- 1) Have the species of phytoplankton that bay scallop sedentary stages and larvae use for food changed during the past 20 or so years to their detriment?
- 2) What are the habitat conditions for scallop juveniles that set in the late summer and fall, including the condition of the eelgrass? In May–June, the eelgrass blades are short-lived and the juvenile scallops are adapted to this by detaching from blades that are cast off and then reattaching to new blades. How do they adapt to eelgrass that might have a different mode of growth in the fall? How does the predation pressure on juvenile scallops that set in September–October compare with that in June–July?
- 3) Bay scallops are eaten by crabs and fishes as described by various authors, but the descriptions of this predation usually are of scallops partially grown, already settled on the bottom, and at least several weeks old. Large numbers of other bivalve species are eaten by predators during the first weeks after they settle out of the plankton.

The species include northern quahogs (MacKenzie, 1977), oysters (MacKenzie, 1981), surfclams, *Spisula solidissima* (MacKenzie et al., 1985), and softshell clams (MacKenzie and McLaughlin, 2000). Aside from the knowledge that mud crabs feed on tiny scallops attached to eelgrass blades (Pohle et al., 1991), do predators such as shrimp, small fishes, and other types of crabs prey on bay scallops when they are 0.2–10 mm long and still attached to eelgrass blades?

- 4) Fishermen and shellfish officers observe large numbers of scallop seed in certain locations at times, but a few months later they have disappeared; moreover, they do not seem to be present in other places. What happens to them?
- 5) Have some bay scallop abundances become too small to produce large enough sets of scallops to restore them to their previous sizes? Probably not, because some scallops have nearly always been able to survive and, when the conditions are "right," rebound to high abundances. In the 1950's through the mid 1980's, large sets of seed scallops often have occurred from what seemed to be small numbers of adults (this assessment of population size is based upon poor harvests by fishermen).

Under laboratory conditions, the toxicity of the pollutants, PAH's and MTBE's that are toxic (Dockum⁴⁸), and also nitrates could be tested on various life stages of scallops.

Acknowledgments

Many people contributed to this research and writing project. The following librarians obtained historical materials from newspapers and documents in Massachusetts: Lynda Ames Byrne, Wareham Free Library (*The Boston Globe*); Debbie Charpentier, the Millicent Library, Fairhaven (*The Fairhaven Star*); and Marie Henke, Nan-

tucket Historical Association. The staff of the New York Public Library recovered many stored volumes of the *Fishing Gazette* for my use in their reading room. Charlie Bradley sent photographs and historical texts from the historical museum in Marion, Mass. The constables of the Massachusetts Shellfish Officers Association freely provided useful information while I attended six of their quarterly meetings in various towns in their state. Interviews with Paul Bagnall, Debra Barnes, David Berube, Rob Coad, Jennifer Francis, Warren Gaines, Tina Moore, Trish Murphy, David Relyea, Charles Sayles, William Sayles, Gary Sherman, Ted J. Smayda, Neil Smith, Peter Wenczel, David Whittaker, Brinkley Willis, and Joseph Zahtla provided useful information and guidance. Others who contributed verbal information are listed in the personal communications. Debra Barnes, Dery Bennett, Victor G. Burrell, Jr., Frank Csulak, Dexter S. Haven, Willis L. Hobart, Mark Homer, Robert N. Reid, Linda L. Stehlik, and D. Whittaker provided reviews of earlier drafts. Tom Finneran, Donna Johnson, and Annette Kalbach helped prepare the figures.

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Papers in the *Marine Fisheries Review* 70(1-4)

70(1)

"The status of the United States population of night shark, *Carcharhinus signatus*," by John K. Carlson, Enric Cortes, Julie A. Neer, Camilla T. McCandless, and Lawrence R. Beerkircher, 1:1-13

"Transboundary movement of Atlantic istiophorid billfishes among international and U.S. domestic management areas inferred from mark-recapture studies," by E. S.

Orbesen, J. P. Hoolihan, J. E. Serafy, D. Snodgrass, E. M. Peel, and E. D. Prince, 1:14-23

"Stanford University's John Otterbein Synder: student, collaborator, and colleague of David Starr Jordan and Charles Henry Gilbert," by Martin R. Brittan and Mark R. Jennings, 1:24-29

"My days on the *Albatross*," by Seaton Schroeder, 1:30-39

70(2)

Special Issue: The truth about Soviet whaling: a memoir

"Foreword," by Yulia V. Ivashchenko, Philip J. Clapham, and Robert L. Brownell, Jr., 2:1-3

"A. A. Berzin and his memoir," by A. V. Yablokov, 1:3

"The truth about Soviet whaling," by Alfred A. Berzin, 2:4-59

70(3-4)

"History of the bay scallop, *Argopecten irradians*, fisheries and habitats in eastern North America, Massachusetts through northeastern Mexico," by Clyde L. MacKenzie, Jr., 3-4:1-5

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